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# 20<sup>TH</sup> INTERNATIONAL CONFERENCE ON BEAR RESEARCH & MANAGEMENT

## PROGRAM AND ABSTRACTS

JULY 17 - 23, 2011

OTTAWA, ONTARIO, CANADA



20<sup>TH</sup> INTERNATIONAL CONFERENCE ON  
BEAR RESEARCH & MANAGEMENT

JULY 17 - 23, 2011

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- Session 1 – Bear Specialist Group Session: Dave Garshelis
- Session 2 – Bears and Climate Change: Chris Servheen
- Session 3 – Conservation Case Studies: Bruce McLellan
- Session 4 – Collaborative Projects in Bear Studies: Gord Stenhouse
- Session 5 – Ecology and Behaviour of Polar Bears: Lily Peacock
- Session 6 – Aboriginal and Traditional Knowledge of Bears: Vicki Sahanatien
- Session 7 – Bear Behaviour: Larry Van Daele
- Session 8 – Physiology of Bears: Marc Cattet
- Session 9 – Population Estimation: Joe Clark
- Session 10 – Population Ecology of Bears: Chuck Schwartz
- Session 11 – Invited Panel on Bear Feeding: Dave Garshelis
- Session 12 – Human—Bear Conflict/Human Dimensions: Lana Ciarniello

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# International Association for Bear Research & Management

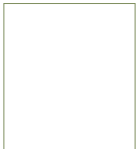
The International Association for Bear Research and Management (IBA) sponsors international conferences and workshops about bear biology, research, and management. The International Conference on Bear Research & Management is the largest of these conferences and is focused on all 8 bear species. The International Conferences are rotated between the Americas and Eurasia on an 18-month rotation. Many of the conference papers are published as peer-reviewed scientific papers in the journal *Ursus*.

The IBA is a non-profit tax-exempt organization open to professional biologists, wildlife managers and others dedicated to the conservation of all bear species. The organization has over 550 members from over 50 countries. It supports the scientific management of bears through research and distribution of information.

The goal of the association is to promote the conservation and restoration of the world's bears through science-based research, management and education.

The eight bear species of the world pose significant research and management problems to governments, local authorities, wildlife biologists, land managers, park personnel, tribal councils, and private land owners. The public endures hardships caused by bears; the public wants bears to survive. Management responsibility for the bears and their habitats rests with numerous national and local agencies and councils. Encroaching civilization, involving land-use conflicts and resource utilization by human beings, has resulted in the decline or disappearance of bear habitat and bear populations in portions of their ranges. Continued viability of populations and the possible restoration of bears in certain areas, will be largely contingent upon a cooperative approach towards research, management, land use, and education, and will increase in cost as land values escalate. The IBA, an association primarily of professional biologists with an interest in bears, recognizes these difficult bear research and management problems faced by agencies and governments.

# Exhibitors

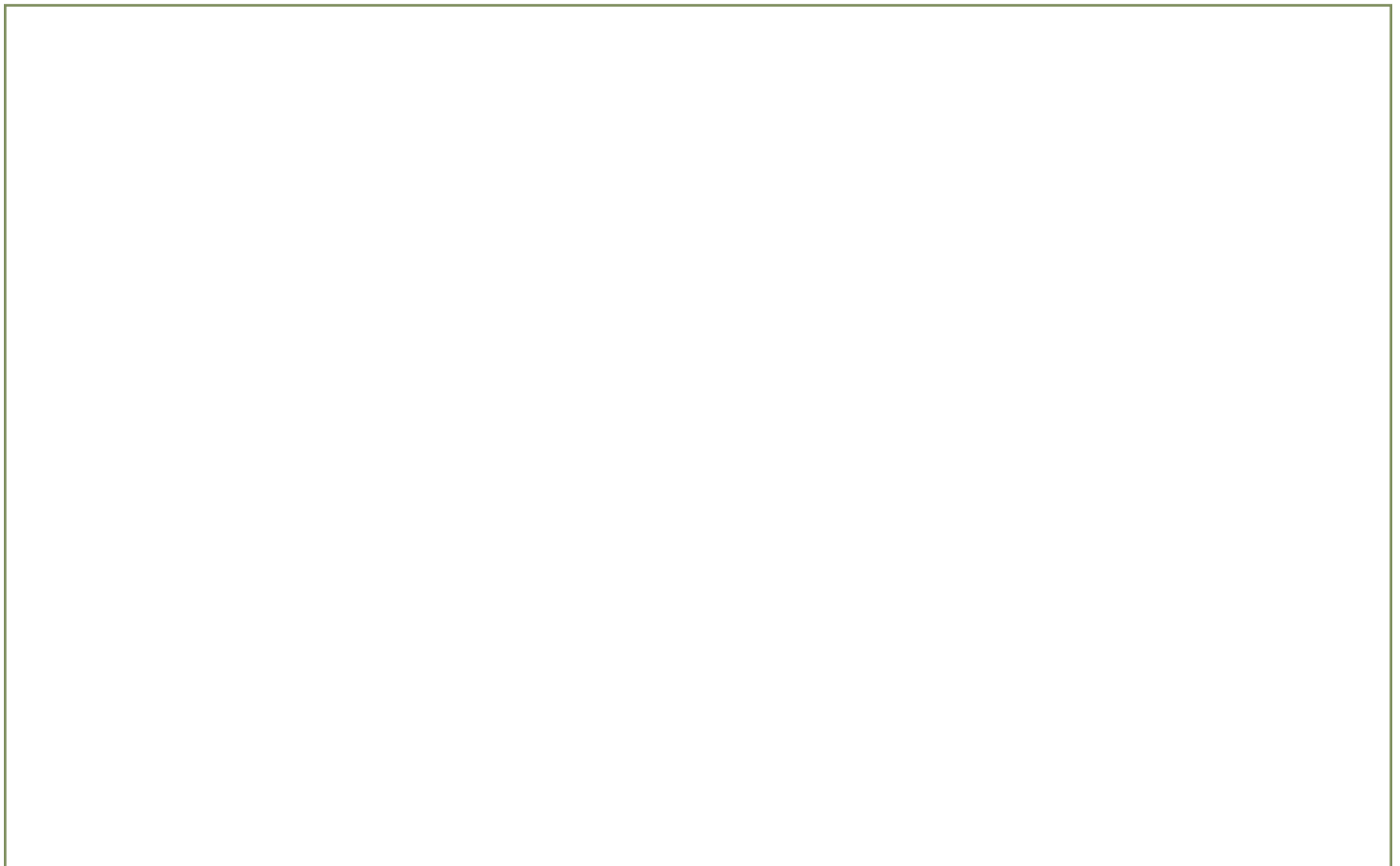
Booth #	Exhibitor	
1	TyeDee Bin is a line of animal resistant garbage and storage containers, designed to keep bears and other nuisance wildlife out of residential or public environment garbage. TyeDee Bin has an all steel construction, with powder coat paint, they have been tested with black, grizzly, and polar bears. <a href="http://www.tyedeebin.com">www.tyedeebin.com</a>	
2	World Wildlife Fund Canada - The Arctic is facing an uncertain future. Yet there is one single threat that outweighs all others: climate change. Global warming in the Arctic is expected to be much higher than the rest of the world, resulting in an ice-free Arctic within this century, threatening arctic communities and animals, with impacts to the entire planet. WWF is working with its many partners across the Arctic to combat these threats and preserve the region's rich biodiversity including the iconic polar bear. Stop by our booth for more information on what we do and how you can help in building a future where people and nature thrive.	
3	Advanced Telemetry Systems (ATS) offers innovative and reliable wildlife tracking products designed for researchers world-wide. We manufacture over 400 models of custom VHF transmitters, receivers/dataloggers with advanced DSP technology, and GPS collars or loggers. NEW AT ATS: Iridium satellite collars, programmable archive tags and more. Visit <a href="http://www.atstrack.com">www.atstrack.com</a> today to get a same day quote and personalized project consultations.	
4	VECTRONIC Aerospace manufactures GPS and VHF equipment for wildlife studies. High quality GPS collars with IRIDIUM, GLOBALSTAR, ARGOS, GSM and UHF Communication.	
5	Haul-All <a href="http://www.haulall.com/bear.htm">http://www.haulall.com/bear.htm</a>	
6	Ontario Ministry of Natural Resources - The Biodiversity Branch of the Ontario MNR develops ecologically-based legislation, policies and programs that promote the conservation and sustainable use of wildlife populations, support biodiversity and enhance the social, economic, cultural, and environmental benefits that wildlife provide to Ontarians.	
7	Bear Wise Ontario - Established in 2004, the MNR Bear Wise Program is committed to reducing preventable causes of human-bear conflict in Ontario. Bear Wise: Teaches people about black bears; Works with community leaders to establish prevention programs; Provides a bear information and reporting line; Works with police to respond to human-bear conflicts. Visit <a href="http://www.ontario.ca/bearwise">www.ontario.ca/bearwise</a> for more information.	
8	Ontario Ministry of Natural Resources - Enforcement For over 100 years Ontario's Conservation Officers have patrolled the province's 1 million square kilometers, protecting wildlife from polar bear in the north to prickly pear cactus in south. The mandate of the Enforcement Branch is to provide effective regulatory protection of Ontario's natural resources, environment and public safety.	
9	Login Canada is the premier Canadian book distributor representing over 500 of the finest publishers in the publishing industry. Please drop by Booth #9 to view what is new in your area of expertise.	
10	Telonics designs and manufactures radio telemetry equipment for wildlife research including GPS, Argos, and VHF systems. Telonics has been a leader in the biotelemetry field and partner in wildlife research projects for more than 40 years.	
11	Polar Bears International is dedicated to the worldwide conservation of the polar bear and its habitat through research, education, and stewardship. The world's leading polar bear scientists guide our projects and support our efforts. Stop by our booth at the conference to explore how we can work with you to help the bears. Visit <a href="http://www.polarbearsinternational.org">www.polarbearsinternational.org</a> for more information.	
12	The <b>Alaska Wildlife Conservation Center</b> is a 501 (c) (3) non-profit, wildlife collection-based living institution, which contributes to conservation through education and outreach as well as through science based initiatives. The Center's sanctuary, set on 200 acres, provides visitors with up-close encounters with our bears and other conservation ambassadors species for the purposes of engagement and education of all ages. <b>Bear Trust</b> is a 501 (c) (3) non-profit, conservation organization founded in 1999 to help conserve wild bears, other wildlife, and habitat by focusing on four core project initiatives: 1) Conservation Education, 2) Wild Bear Research, 3) Wildlife Management, and, 4) Habitat Conservation. Bear Trust identifies gaps in research knowledge and needs in bear conservation, develops projects to address gaps and needs, delivers scientific results to wildlife managers to positively affect conservation, and develops innovative education programs based on bear research. Bear Trust works collaboratively with governmental and non-governmental organizations worldwide to optimize resources for the purpose of bear conservation.	
13	Lotek Wireless <a href="http://www.lotek.com">http://www.lotek.com</a>	
14	The Spectacled Bear Conservation Society (SBC) is a Canadian registered nonprofit and was founded in 2007. The goal of SBC is to ensure the conservation of the spectacled bear in the dry forest of northern Peru through scientific research and education while working collaboratively with private land owners and rural communities to improve their social and economic well being.	
15	IBA Reprints Exchange Table	

# Finding your way

## IBA conference floorplan



## The Westin floorplan



# Entertainment

## East Side Trio

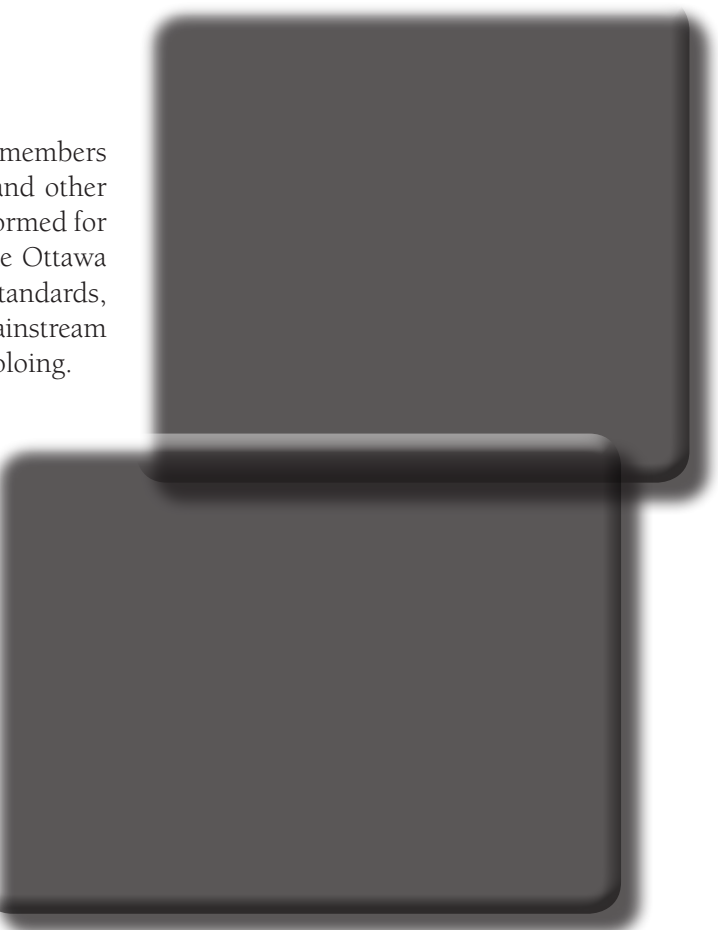
*Sunday, July 17: 7:00 p.m. – 8:30 p.m.*

*in the Governor General Ballroom I/II*

East Side Trio, lead by saxophonist Ralph Hopper, draws its' members from a group of musicians who have been performing jazz and other styles of music for many years. The trio and quartet have performed for many events in the Ottawa area including several years at the Ottawa Jazz Festival. The trio has an extensive repertoire of jazz standards, non-jazz tunes and original tunes that they perform in a mainstream style, emphasizing melody and rhythm along with inspired soloing.

Ralph will be joined for this performance by Shinya Sato on piano and Paul Soble on bass. Shinya plays with a light, introspective and highly melodic style and Paul is one of the most in demand bass players in Ottawa with his very solid lines and wonderful soloing style.

More information available at [www.ralphhopper.ca](http://www.ralphhopper.ca)



## Herringbone

*Friday, July 22: 6:30 p.m.*

*in the Confederation Ballroom I/II*

Herringbone was born around a campfire at Fitzroy Harbour just west of Ottawa, Canada. Herringbone's repertoire is based mainly on the rich Celtic heritage, including music from Ireland, Scotland, and the Canadian Maritimes. The band's range of styles covers classic ballads like Danny Boy, The Banks of the Roses and The Fields of Athenry, but they most often play more spirited tunes about whiskey, women, shipwrecks, and war. Using the variety of instruments the musicians bring to their gigs, Herringbone can (and usually does) move outside the Celtic sphere. The wide variety of musical instruments and experiences allow the range of styles needed to play diverse venues, from coffee houses to concert halls and from kitchen parties to dance clubs.

More information available at [www.herringbone.ca](http://www.herringbone.ca)





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## Bear Wise – A shared approach to preventing human-bear conflict.

Established in 2004, the Ministry of Natural Resources Bear Wise Program is committed to reducing preventable causes of human-bear conflict in Ontario.

Bear Wise:

- Teaches people about black bears and provides strategies they can adopt to keep bears wild.
- Works with community leaders to establish local prevention programs.
- Offers many education and awareness products.
- Provides a Bear Information and Reporting line.
- Works in partnership with police to respond to human-bear conflicts.

[ontario.ca/bearwise](http://ontario.ca/bearwise)

## PROGRAM OUTLINE & SCHEDULE



<b>Sunday, July 17</b>	
9:00 a.m. – 5:00 p.m.	IBA Council Meeting; <i>The Westin Ottawa, Newfoundland/Nova Scotia Room</i>
1:00 p.m. – 8:00 p.m.	Registration; <i>The Westin Ottawa, 4th Floor Foyer</i>
1:00 p.m. – 8:00 p.m.	Poster / exhibitor setup; <i>The Westin Ottawa, Provinces I &amp; II / 4<sup>th</sup> Floor Foyer</i>
7:00 p.m. – 8:30 p.m.	Conference icebreaker and reception; <i>The Westin Ottawa, Governor General Ballroom I/II</i>

<b>Program outline and session themes</b> <i>Plenary sessions will take place in The Westin Ottawa, Confederation Ballroom I &amp; II</i>	
<b>Monday, July 18</b>	
8:30 a.m.	Welcome and Opening Remarks
9:00 a.m.	Session 1: Bear Specialist Group session - Reports from expert teams
1:00 p.m.	Session 2: Bears and Climate Change
7:30 p.m.	Climate Change and Bears workshop - C. Servheen
<b>Tuesday, July 19</b>	
8:10 a.m.	Session 3: Conservation Case Studies
10:30 a.m.	Session 4: Collaborative Projects in Bear Studies
1:30 p.m.	Session 5: Ecology and Behaviour of Polar Bears
3:50 p.m.	Session 6: Aboriginal and Traditional Knowledge of Bears
5:30 p.m. – 6:30 p.m.	Poster session 1 ( <i>Provinces I &amp; II</i> )
8:00 p.m.	Public Session - Dr. I. Stirling and Dr. S. Herrero ( <i>Confederation I &amp; II</i> )
<b>Wednesday, July 20</b>	
All day	Field trips

Thursday, July 21	
8:10 a.m.	Session 7: Bear Behaviour
10:30 a.m.	Session 8: Physiology of Bears
1:10 p.m.	Session 9: Population Estimation
4:00 p.m.	Session 10: Population Ecology of Bears
5:30 p.m.- 6:30 p.m.	Silent Auction
5:30 p.m.- 7:00 p.m.	Poster Session II ( <i>Provinces I &amp; II</i> )
7:30 p.m.	<b>Concurrent Workshops:</b> Population Estimation workshop - M.Efford ( <i>Confederation I &amp; II</i> ) Facilitating Collaborative Partnerships workshop - R. VanHorn ( <i>Québec room</i> )
Friday, July 22	
8:10 a.m.	Session 11: Invited Panel on Bear Feeding
11:40 a.m.	Session 12: Human - Bear Conflict / Human Dimensions
1:00 p.m.	IBA Members Meeting
2:00 p.m.	Session 12: Human - Bear Conflict / Human Dimensions cont'd
7:00 p.m.	Closing Banquet ( <i>Confederation I &amp; II</i> )
Saturday, July 23	
9:00 a.m.	Concurrent Workshops: Large Enclosures for Captive Bears workshop- J. Schaul ( <i>Québec room</i> ) Current Issues and New Techniques for Handling Bears workshop - G. York ( <i>Nova Scotia/Newfoundland rooms</i> )

Presentations	
<b>Monday, July 18</b>	
8:30 a.m.	Introduction <i>M. Obbard &amp; F. Van Manen</i>
8:40 a.m.	Official Welcome and Opening Remarks <i>Honourable Linda Jeffrey, Ministry of Natural Resources</i>
9:00 a.m.	<b>Session 1:</b> Bear Specialist Group Session <i>Expert Teams Reports</i>
10:00 a.m.	<b>Coffee Break</b>
10:30 a.m.	<b>Session 1 (cont'd):</b> Bear Specialist Group Session <i>Expert Teams Reports</i>
12:00 p.m.	<b>Lunch Break</b>
1:00p.m.	<b>Session 2: Bears and Climate Change</b>
1:10 p.m.	An overview of anticipated global climate changes for the 21st century and their associated uncertainties at the regional-scale - <i>P. Gachon (Invited)</i>
1:40 p.m.	GPS telemetry and habitat modeling identify linkage zones in fragmented region of western North America providing adaptive options for grizzly bear response to climate change - <i>M. Proctor et al</i>
2:00 p.m.	Denning behaviour and climate change: Linking environmental variables to denning of grizzly bears in the Rocky Mountains and boreal forest of Alberta, Canada. - <i>K. Pigeon et al.</i>
2:20 p.m.	How are polar bears ( <i>Ursus maritimus</i> ) adjusting their physiology and behavior to cope with climate change? - <i>J. Whiteman et al.</i>
2:40 p.m.	A tale of two polar bear populations: ice habitat, harvest, and body condition - <i>K. Rode et al.</i>
3:00 p.m.	<b>Coffee Break</b>
3:20 p.m.	Potential implications of climate change on grizzly/brown bears in North America - <i>S. Nielsen and B. McLellan</i>
3:40 p.m.	Giant Panda and climate change - <i>M. Songer</i>
4:00 p.m.	Global warming: A threat for the Andean bear? - <i>S. Garcia-Rangel and G. Papadakis</i>
4:20 p.m.	Polar bear population projections: reliability in the face of uncertainty - <i>S. Amstrup (Invited)</i>
5:00 p.m.	<b>Dinner Break and Announcements</b>
7:30 p.m.	<b>Workshop</b> - Climate Change and Bears - <i>C. Servheen</i>
<b>Tuesday, July 19</b>	
8:00 a.m.	<b>Announcements</b>
	<b>Session 3: Conservation Case Studies</b>
8:10 a.m.	The Challenge of Bear Conservation in Developing Countries of the World - <i>E. Can</i>
8:30 a.m.	The effects of selective logging on sun bears in lowland dipterocarp rainforest of Borneo - <i>S. Wong et al.</i>
8:50 a.m.	Sun bears in India: Conservation vs. Threats - <i>N.P.S. Chauhan and P. Mardaraj</i>
9:10 a.m.	Conservation and Research Status of Brown bear from 2008 to 2011 in Nepal - <i>A. Aryal</i>
9:30 a.m.	Status of Sloth bears in north Gujarat, India and their conservation opportunities - <i>N. Dharaiya et al</i>
9:50 a.m.	Community engagement, para-biologist training and Andean bear conservation in and around southern Sangay National Park, Ecuador - <i>B. Zug et al</i>

10:10 a.m.	<b>Coffee Break</b>
	<b>Session 4: Collaborative Projects in Bear Studies</b>
10:30 a.m.	Population Fragmentation and Inter-ecosystem Movements of Grizzly Bears in Western Canada and the Northern USA - <i>M. Proctor et al (Invited)</i>
11:00 a.m.	One species, two continents, three patterns of growth; brown bears in North America and Europe - <i>A. Zedrosser et al</i>
11:20 a.m.	Polar bears are seasonally motivated to discriminate conspecific sex and reproductive status via pedal scent - <i>M. Owen et al.</i>
11:40 a.m.	How well can we use photographs to identify Andean bears, assess their kinship, and estimate their ages? - <i>R. Van Horn et al.</i>
11:50 a.m.	Is it ethical to capture brown bear offspring? - <i>H. Reynolds et al</i>
12:10 p.m.	<b>Lunch Break</b>
	<b>Session 5: Ecology &amp; Behaviour of Polar Bears</b>
1:30 p.m.	Interrelationships between polar bears, seals, sea ice and climate in northern Labrador and Davis Strait - <i>I. Stirling et al.</i>
1:50 p.m.	Population Ecology of Polar Bears in Davis Strait, Canada and Greenland - <i>E. Peacock et al.</i>
2:10 p.m.	Multi Scale Assessment of Polar Bear Habitat in Seasonal Sea Ice, Foxe Basin, Nunavut - <i>V. Sahanatien et al.</i>
2:30 p.m.	Individual Dietary Specialization in Polar Bears - <i>G. Thiemann et al.</i>
2:50 p.m.	Long-distance swimming events by adult female polar bears in the Beaufort and Chukchi seas - <i>A. Pagano et al.</i>
3:10 p.m.	Polar bear politics, ecology, and conservation in Canada - <i>A. Derocher and P. Molnar</i>
3:30 p.m.	<b>Coffee Break</b>
	<b>Session 6: Aboriginal and Traditional Knowledge of Bears</b>
3:50 p.m.	Grizzly bears as the Umbrella Species for the St'at'imc First Nation Culture - <i>S. Senger</i>
4:10 p.m.	Do grizzly bears eat mountain sheep? A search for evidence in a northern alpine ecosystem - <i>C. Lambert-Koizumi and A. Derocher</i>
4:30 p.m.	Significance of Mashiramo ( <i>Tremarctos ornatus</i> ) to the Yupka's communities in the Columbian Serrania Del Perijá - <i>E. Rodriguez</i>
4:50 p.m.	Cree Understanding of Wabusk: Documenting traditional knowledge of Polar Bears in the Hudson Bay Lowlands of Ontario - <i>M. Kakekespan</i>
5:10 p.m.	Combining Inuit Ecological Knowledge and Western Science in Wildlife Governance: The Case of Polar Bear Co-Management in Nunavut - <i>D. Henri and E. Peacock</i>
5:30 p.m.	<b>Dinner Break and Announcements</b>
8:00 p.m.	<b>Public Session</b> - <i>I. Stirling and S. Herrero</i>
<b>Thursday, July 21</b>	
8:00 a.m.	<b>Announcements</b>
	<b>Session 7: Bear Behaviour</b>
8:10 a.m.	Seasonality of Reproduction in Wild Spectacled Bears in the Dry Forest of Cerro Venado, Peru - <i>R. Appleton et al.</i>
8:30 a.m.	Whistles and slingshots increase the wariness of American black bears - <i>L. Homstol and C. St Clair</i>
8:50 a.m.	Evidence for Conspecific Cueing in Guiding Landscape-Level Movements of American Black Bears in Northcentral Minnesota - <i>K. Noyce and D. Garshelis</i>
9:10 a.m.	Grizzly Bear and Black Bear Marking Behavior - <i>K. Kendall et al.</i>
9:30 a.m.	Intraspecific Relationships Between Brown Bears, Asiatic Black Bears and the Amur Tiger - <i>I. Seryodkin et al.</i>

9:50 a.m.	The Noble Cat and the Big Bad Scavenger: The Effects of Kleptoparasitism by Brown Bears on Eurasian Lynx - <i>M. Krofel</i>
10:10 a.m.	<b>Coffee Break</b>
	<b>Session 8: Physiology of Bears</b>
10:30 a.m.	Non-invasive monitoring of ovarian function in polar bears ( <i>Ursus maritimus</i> ) by measuring fecal steroid metabolites. - <i>A. Mendoza et al.</i>
10:50 a.m.	Non-invasive Fecal Hormone Monitoring for Evaluating Polar Bear ( <i>Ursus maritimus</i> ) Reproductive Activity - <i>T. Roth et al.</i>
11:10 a.m.	The brown bear as a reverse translational model for human health and disease - <i>O. Fröbert and J. Swenson</i>
11:30 a.m.	Characterization of polyestrus in American black bears, <i>Ursus americanus</i> - <i>T. Spady et al.</i>
11:50 a.m.	The critical role of captive bears in assessing stress in wild Asiatic Black Bear populations in southwest China - <i>K. Malcolm et al.</i>
12:10 p.m.	<b>Lunch Break</b>
	<b>Session 9: Population Estimation</b>
1:10 p.m.	Estimating bear populations by spatially explicit capture-recapture - <i>M. Efford (Invited)</i>
1:40 p.m.	Genetic tagging free-ranging black bears and grizzly bears since 1995: implications for population-level studies of bears and other wildlife - <i>J. Woods et al (Invited)</i>
2:00 p.m.	Effects of Subsampling Genotyped Hair Samples to Estimate Black Bear Abundance - <i>J. Laufenberg et al.</i>
2:20 p.m.	Grizzly bear Abundance, Distribution, Connectivity and Conservation across the Southern Coast Ranges of British Columbia - <i>C. Apps et al.</i>
2:40 p.m.	Estimating the Asiatic black bear Population using different techniques-a case study from Dachigam National Park, Kashmir, India – <i>S. Sathyakumar et al.</i>
3:00 p.m.	Density estimation of Asiatic Black Bear and Sun Bear using chest marks and photographic capture recapture sampling - <i>D. Ngoprasert and G. Gale</i>
3:20 p.m.	Aerial survey estimation of abundance for polar bears during the ice-free season - <i>S. Stapleton et al.</i>
3:40 p.m.	<b>Coffee Break</b>
	<b>Session 10: Population Ecology of Bears</b>
4:00 p.m.	Population regulation of grizzly bears on an industrialized landscape: the case of the changing bottom - <i>B. McLellan</i>
4:20 p.m.	Silver spoons, forest landscapes, and grizzly bear body size patterns in Alberta - <i>S. Nielsen et al.</i>
4:30 p.m.	Effects of conspecifics on habitat selection by grizzly bears in the southwest Yukon, Canada - <i>R. Maraj et al.</i>
4:50 p.m.	Litter size reduction reveals sibling competition in brown bear <i>Ursus arctos</i> - <i>O. Gonzalez et al.</i>
5:10 p.m.	Are bears effective seed disperser in the temperate forest ecosystem? Estimate of the seed shadow created by the Asiatic black bear - <i>S. Koike et al.</i>
5:30 p.m.	<b>Dinner Break and Announcements</b>
7:30 p.m.	<b>Workshop</b> - Spatially-explicit capture-recapture population estimation - <i>M. Efford</i>
7:30 p.m.	<b>Workshop</b> - Facilitating collaborative partnerships to improve bear research, conservation, and husbandry of captive and free-ranging bears - <i>R. Van Horn</i>
<b>Friday, July 22</b>	
8:00 a.m.	<b>Announcements</b>

	<b>Session 11: Invited Panel on Bear Feeding</b>
8:10 a.m.	Bear feeding: an overview of current policies and state of knowledge - <i>J. Hechtel</i>
8:30 a.m.	A fed bear is a dead bear: how this catchy phrase and management philosophy led to positive changes for bears and visitors in national parks - <i>K. Gunther</i>
8:50 a.m.	Can food lead black bears out of trouble? - <i>L. Rogers</i>
9:10 a.m.	Experimental Diversionary Feeding of Black Bears at Lake Tahoe, CA - <i>A. Bryant</i>
9:30 a.m.	Food for thought: why diversionary feeding may not be an effective management tool for urban human-bear conflicts - <i>S. Baruch-Mordo</i>
9:50 a.m.	Effects of supplemental feeding on bear spatial behavior, habituation on people, and human-bear conflicts: studies of long-term intensive feeding of brown bears in Slovenia, Europe - <i>K. Jerina</i>
10:10 a.m.	<b>Coffee Break</b>
	<b>Invited Panel on Bear Feeding (cont'd)</b>
10:30 a.m.	Discussion - Led By D. Garshelis
	<b>Session 12: Human -Bear Conflict / Human Dimensions</b>
11:40 a.m.	Human-Bear Conflict: A Review of Concepts and Global Trends - <i>N. D'Cruze et al.</i>
12:00 p.m.	<b>Lunch Break</b>
1:00 p.m.	IBA Members Meeting <i>F. Van Manen</i>
	<b>Human-Bear Conflict / Human Dimensions (cont'd)</b>
2:00 p.m.	Factors driving range requirements and habitat use of a population living on the edge: <i>Ursus americanus</i> thriving in a fragmented, agricultural landscape - <i>M. Dittmer et al.</i>
2:20 p.m.	Human-bear conflicts influence villagers' attitudes but not necessarily behaviors – <i>F. Liu et al.</i>
2:40 p.m.	Trekkers' preferences for bear-encounter risk management in Daisetsuzan National Park, northern Japan: Using a choice experiment - <i>T. Kubo and Y. Shoji</i>
3:00 p.m.	Investigation on black bear-human conflict in Kashmir, India - <i>U. Singh et al.</i>
3:20 p.m.	<b>Coffee Break</b>
3:40 p.m.	Socio-economic Survey of Rehabilitated Kalandars in India, (Pre and Post Rehabilitation) - <i>I. Kumari et al.</i>
4:00 p.m.	Identification of human-bear conflict zones for Andean bears in Bolivia - <i>X. Velez-Liendo</i>
4:20 p.m.	Hunting brown bears as a key management tool in Croatia - <i>D. Zec et al</i>
4:40 p.m.	Interaction Between Grizzly Bears and Backcountry Users in Yellowstone National Park, Bear Management Areas - <i>T. Coleman et al.</i>
5:00 p.m.	Poaching of sloth bear cubs and illegal trade routes in India - <i>K. Satyanarayan</i>
5:20 p.m.	Conference Closing <i>M. Obbard &amp; F. Van Manen</i>



SESSION 1:

BEAR SPECIALIST GROUP SESSION



## Status of the world's bears: threats and conservation measures

This session will provide a broad overview of the current status of the world's bears and an assessment of efforts to conserve them. The Bear Specialist Group (BSG) will present a series of reports highlighting major threats and conservation measures concerning the 7 species of terrestrial bears. Data were gathered mainly by surveying BSG members, representing 56 countries. Reports will underscore and compare the primary threats to each species of bear in different regions of the world. Additional reports will focus on two particularly pervasive threats: the trade in bear parts and human-bear conflicts. The series of reports will also assess the effectiveness of principal conservation actions, directed either specifically toward bears or targeted toward other species but potentially benefitting bears. Suggested improvements to these actions and/or implementation of additional conservation measures will be discussed. The current extent of knowledge related to issues affecting bear conservation and the chief methods used to obtain this information will be addressed. Reports highlighting conservation concerns in three specific countries will also be presented, as well as a report about the connection between captive bears and conservation.

Report	Authors	Time allotted (min), incl. questions
European Brown Bears	Djuro Huber & Jon Swenson	11
North Asian Brown Bears	Larry Van Daele & Tsutomu Mano	11
South Asian Brown Bears	Emre Can & S. Sathyakumar	11
Asiatic Black Bears	Dave Garshelis & Mei-hsiu Hwang	11
Bears in Iran	G. Hosein Yusefi	7
Sun Bears	Gabriella Fredriksson & Rob Steinmetz	11
Bears in Laos	Lorraine Scotson	7
Trade in Bear Parts	Chris Servheen & Chris Shepherd	11
Sloth Bears	Thomas Sharp, Naim Akhtar & Harendra Bargali	11
Giant Pandas	Dajun Wang & Ron Swaisgood	11
Andean Bears	Ximena Velez-Liendo & Isaac Goldstein	11
Bears in Mexico	Diana Doan Crider	7
Human-Bear Conflicts	John Beecham	11
Captive Bears	Lydia Kolter	11

SESSION 2:

BEARS AND CLIMATE CHANGE

# An overview of anticipated global climate changes for the 21st century and their associated uncertainties at the regional-scale

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Due to continuous increase in greenhouse gases and aerosol concentrations in the atmosphere from human activities, climate change will significantly exceed natural climate variability, but with inherent uncertainties in projected values. This paper will present an overview of the anticipated climate change for the 21st century at the global and continental scales, as suggested from the state-of-the-art atmosphere-ocean global climate models (AOGCMs) used within the last Fourth Assessment Report of the International Panel on Climate Change (IPCC, 2007). The global annual average surface air temperature simulated by various AOGCMs is projected to warm between 1.1 and 6.4°C by 2090-2099 relative to 1980-1999, to be most significant in polar and sub-polar regions, and to be largest in winter and spring than in summer. In spite of the gradual increase in temperature suggested by all AOGCMs, the differences between models also increase with time, and are higher for snow cover (cold) seasons than for summer. This paper will also investigate the various sources of uncertainties in regional climate change scenarios issued mainly from downscaling models, and internal natural variability of the climate system. Some examples are given from the cascade of uncertainties (i.e. within the AOGCMs/downscaling models) over various areas of North America where significant changes are anticipated to occur over the 21st century. Their effects on the projected temperature and precipitation regimes for both mean and extreme climate are discussed. Some suggestions are given to address and/or reduce these uncertainties within the context of various applications in climate change impact studies, especially when the natural ecosystems, where the world's bear species subsist, are concerned and are at present sensitive to various ranges of disturbance.

# GPS telemetry and habitat modeling identify linkage zones in fragmented region of western North America providing adaptive options for grizzly bear response to climate change

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Recent research has shown that grizzly bear (*Ursus arctos*) populations across southern Canada and northern USA are fragmented by human settlement and major highways. It is predicted that climate change will exacerbate existing fragmentation, further challenging species' abilities to adapt. In response to both current management needs and those expected as a result of climate change, we began research to enhance inter-area connectivity throughout southern Canada and northern USA. Our goals are to increase inter-area movements to resist extirpation of several small fragmented sub-populations, and provide for the spatial needs of grizzly bears trying to adapt to a rapidly changing environment as a result of climate change. To accomplish these goals, our first step was to identify linkage habitat through existing fracture zones, followed by implementing management actions designed to enhance bear movements through human environments. Using >50,000 GPS telemetry locations from 31 grizzly bears in the Canada/USA trans-border region we used resource selection function (RSF) habitat modeling to identify backcountry core habitat and front-country linkage habitat across 5 highway and settlement corridors in the Purcell, Selkirk, and Cabinet Mountains of southern Canada, northwest Montana, and northern Idaho. Habitat models were built comparing GPS locations (used habitat) against an equal number of random locations (available habitat) within GIS using logistic regression, and 27 ecological, terrain, and human-use variables. Models were selected using AIC methods and validated by a combination of withheld data in areas where models were developed and independent bear GPS locations in areas where we extrapolated our models. Our results consist of a series of predicted core habitat areas and linkage zones across the 5 highway and settlement systems. Private land purchases, conservation easements, public education, and other management actions on public lands secure these linkage zones for movement of wildlife.

# Denning behaviour and climate change: linking environmental variables to denning of grizzly bears in the Rocky Mountains and boreal forest of Alberta, Canada

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Climate change may act as an additional strain on fragile wildlife populations affected by other factors such as habitat loss and excessive human-caused mortality. The effects of climate change on fragile populations will likely be more pronounced during energetically demanding periods such as winter. Hibernation patterns, which are widely viewed as an adaptation to cope with unfavourable environmental conditions primarily driven by a decrease in food availability and ambient temperatures, may be modified by recent climate change. Our objective was to identify the potential consequences of climate change on the denning behaviour of grizzly bears by investigating links between environmental variables and hibernation patterns. We investigated the behaviour of grizzly bears denning in the Rocky Mountains and boreal forest of Alberta, Canada, from 1999 to 2010. We used GPS technology to determine den entry and emergence dates, as well as the number of days spent near den sites prior and post denning for 46 female and 21 male grizzly bears. Overall, females entered dens earlier and emerged later than males. Pregnant females hibernated for a greater number of days than all other bears followed by lactating and non-lactating females respectively. For females, the timing of den entry and the duration of the denning period also varied by year and fall temperatures suggesting that females might be susceptible to climate-induced modifications in hibernation patterns. Climate-induced changes in the denning behaviour of female bears may increase human-bear interactions as climate continues to warm. Since human-bear conflict is the primary cause of grizzly bear mortality in Alberta, our results may have important management implications for the long-term survival of grizzly bear populations.

# How are polar bears (*Ursus maritimus*) adjusting their physiology and behaviour to cope with climate change?

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Previous research indicates that polar bears can reduce energetic expenditures (by reducing metabolic rate and activity levels) and efficiently utilize stored energy reserves; abilities which could provide critical means to survive periods of limited access to their preferred prey, seals. During summer in the southern Beaufort Sea, some bears follow the retreating sea ice north while others remain land-bound. As a result of climate change, ice retreat is extended, forcing bears to remain on shore longer and carrying ice-bound bears into areas where seal density may be low. We are investigating how both groups of bears adjust their energy uses and body reserves to cope with these conditions, and ultimately, how climate change will affect population dynamics. In 2008 and 2009, 38 adult bears were captured in early summer. Tissue samples were collected and each individual was implanted with a temperature ( $T_b$ ) logger and fitted with a radio transmitter; 18 bears were recaptured in late summer, re-sampled and instruments recovered. Preliminary analyses of  $\delta^{13}\text{C}$  of exhaled  $\text{CO}_2$ , respiratory quotients (RQs), serum urea:creatinine ratios, and  $T_b$  suggest that ice-bound bears exhibit slightly reduced metabolic rates and may exhaust their lipid stores during fasting. Bears on shore had variable metabolic rates and appeared not to exhaust lipid stores. Pending analyses of activity levels,  $\delta^{13}\text{C}$  of fat tissue,  $\delta^{15}\text{N}$  of muscle tissue, muscle morphology, serum non-esterified fatty acids, and other blood parameters will clarify the benefits and drawbacks of remaining on shore and following the sea ice north in the context of changing summer conditions. Principal funding from US National Science Foundation (0732713).

# A tale of two polar bear populations: ice habitat, harvest, and body condition

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Polar bears depend on sea ice for nearly all aspects of their life history. To date, however, effects of sea ice loss have been documented for only two of 19 recognized populations and in only one population within two of four identified ice ecoregions. More broadly, effects of sea ice loss on other populations that differ in harvest management, population density, and/or feeding ecology has been assumed, but empirical data are often lacking. We examined trends in body condition metrics (axillary girth and zygomatic skull width) and relationships with summertime ice concentration (i.e., between May 15 and October 15) between 1977 and 2010 for the Baffin Bay (BB) and Davis Strait (DS) polar bear populations. Polar bears in these regions occupy areas with annual sea ice between Canada and Greenland. Morphometric data were available for 345 BB polar bears and 151 DS bears captured prior to 1990, and 680 and 1223 BB and DS polar bears after 1990. Despite differences in harvest rate, population density, ice concentration, and prey base, polar bears in both populations exhibited positive relationships between body condition and summertime sea ice cover between the 1990s and 2000s. Furthermore, all sex and age classes exhibited declines in body condition during this time period that were not apparent during the earlier time period (1977-1990s) when sea ice loss did not occur. Our results suggest that unidirectional declines in sea ice are affecting the body condition of polar bears in these two populations. Given that the Baffin Bay population is currently being harvested at one of the highest rates for any polar bear population, we suggest that it is unlikely that harvest aimed to reduce densities, even at the highest levels typical for polar bear populations, can negate the effects of reduced sea ice habitat on body condition.

# Potential implications of climate change on grizzly/brown bears in North America

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Most organisms, including bears, are regulated by top-down and bottom-up effects, of which climate change will undoubtedly influence both. Humans are the major top-down limiting factor of grizzly bears and we predict that in North America, a warming climate will redistribute people, at least seasonally, northward resulting in greater overlap with grizzly bears. This will exacerbate human-bear conflicts, habitat conversion, and fragmentation of bear populations. Bottom-up effects of climate change, on the other hand, will be more complex since they involve ecological relationships for more species. Salmon, ungulates, fruiting shrubs, roots, and stone pine seeds are perhaps of most concern since they provide the major energy base that bears depend on. The influence of climate on ocean and stream temperatures, wildfire frequency and extent, snowfall, and insect/disease outbreaks will all affect the distribution and abundance of these resources in both positive and negative ways. In spite of these changes, we expect that grizzly bears, which are extreme habitat generalists, will adapt to changing climates and perhaps even in some areas expand their distribution. The more important management challenge for grizzly bears in a warming climate will be the management of human activity and settlement within grizzly bear range as people escape the warmer south for cooler areas at higher latitudes and altitudes.



# Assessing impacts of climate change on giant panda habitat

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Climate change is predicted to be one of the most significant drivers of extinction by the end of the century and it is thought to be of particular concern for species that are restricted to isolated habitat fragments. Given the giant panda's restricted geographic distribution, as well as the potential climate sensitivity of montane forests, climate change may significantly reduce and isolate already fragmented giant panda habitats, decrease gene flow, and thereby substantially increase the species' extinction risk. We used current giant panda geographic distribution and general climate models and species distribution modeling to predict future distribution and fragmentation of giant panda habitat. Results support two of the major general predictions of climate warming – a shift of habitats towards higher latitudes and towards the pole. Our models show climate change may reduce suitable habitat by nearly 60% over 70 years. Beyond the current geographic range new areas may become suitable, but only 15% of these are currently protected. In addition, most of the new area is far from the current giant panda distribution. Long-term survival of giant pandas will require the creation of new protected areas that are likely to support suitable habitat even if the climate changes. Different climate scenarios produce varying predictions of the spatial distribution of future suitable habitat. By delineating areas where habitats are predicted to persist under multiple climate change scenarios, we developed a reserve design selection scheme to inform planning strategies.

# Global warming: a threat for the Andean bear?

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The impacts of global warming are currently visibly across Latin America through coral bleaching, hurricane intensification, glacial retreats and disruption of precipitation cycles. All of this, in a region where human-population growth is higher than the global average, and which is heavily dependent in the exploitation of natural resources from seriously deteriorated ecosystems. Particularly across the Andes, soil erosion, deforestation and lack of planning are having direct impacts on food production, water supply, transport capabilities and hydro-electric power generation, as well as increasing the risk of natural disasters and the threats imposed to the unique biota of the mountain range. Global warming is expected to intensify these effects through temperature rises surpassing those in their surroundings, and so to impose even greater challenges for the preservation of local ecosystems and the growth of developing economies. We carried out a preliminary evaluation of the impact of global warming on the Andean bear (*Tremarctos ornatus*) across the Northern Andes (i.e. Colombia, Venezuela, Ecuador and northern Perú) to open the door for more detailed research on this subject. Using available climatic and land-cover datasets (e.g. WorldClim, MODIS), we modelled distributional changes in vegetation types associated with the species (i.e. evergreen forests and high-elevation shrublands), together with variations in habitat suitability for important food resources on Andean bear's diet. These results were then compared to changes caused by projected increases in human-population density to assess their prevalence over existing threats. Finally, we examined the role of protected areas in the long-term survival of Andean bears based on the scenarios obtained. Here, we present the results of these analyses and propose further questions to be addressed for a detailed evaluation of the impact of global warming on the Andean bear.

# Polar bear population projections: reliability in the face of uncertainty

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Polar bears are dependent on the sea ice for access to their marine mammal prey. Observed sea ice declines have been linked to reduced body condition and stature, altered feeding and movement patterns, reduced survival, and population declines. Based upon sea ice losses due to projected rise in greenhouse gases (GHGs), my research team concluded in 2007 that two-thirds of the world's polar bear population could disappear by mid-century. But how could we project the distant future for polar bears given the chaos in the climate system, and given that adverse effects of changing sea ice have not occurred simultaneously across the polar bear's circumpolar range? GHGs slow the rate at which earth returns solar energy back to space just as your body heat escapes more slowly from the outer surface of a sleeping bag than it escapes from the surface of your skin if you are sleeping naked under the stars. The thicker the sleeping bag, the warmer you sleep. The higher the atmospheric concentration of GHGs, the slower the escape of heat from earth and the warmer we are. On Venus the atmosphere is saturated at the spectral bands where CO<sub>2</sub> blocks IR transmission, and the mean surface temperature is ≈460°C. Yet even there, adding CO<sub>2</sub> to the atmosphere would raise surface temperatures by increasing the altitude in the atmosphere to which long wave radiation must climb before its energy can escape into space. Natural variations in weather and climate mean we cannot predict the first year when reduced spatio-temporal extent of sea ice will prevent female polar bears from reaching their traditional denning areas or from achieving weight gains necessary for reproduction. Yet, without mitigating GHG rise, exceeding these and other critical thresholds is inevitable. The longer we delay in limiting GHG emissions, the more thresholds will be exceeded and the lower probability polar bears will persist. The uncertainty in the climate system, therefore, does not preclude reliable projections for a distant future in which GHG concentrations continue to increase.

SESSION 3:

CONSERVATION CASE STUDIES

# The challenge of bear conservation in developing countries of the world

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Conservation of bears is a real challenge in developing countries. Working for conservation on the ground in developing countries is fraught with many inherent difficulties. Many people live a subsistence lifestyle, where they frequently interact and conflict with wildlife such as bears, because they share many of the same resources. Ironically, some of the last strongholds for bears in many of the world's ecoregions occur in developing countries where habitats have not yet become totally dominated by humans. This is a precarious situation, because as these countries strive to become more developed and to increase the standard of living of their people, the habitats currently harboring bears will suffer. It is therefore imperative that as nations develop economically, they also develop a conservation ethic and train scientists and conservation biologists who will guide them through the process. This is a complex undertaking, not only because their capacity-building structure is lacking, as are the necessary financial resources, but it is difficult to work against economic improvement and the increasing needs of people in burgeoning populations. Here I discuss these myriad issues as they impact bear conservation. I address this from the standpoint of a bear biologist frustrated by inadequate training and resources, and by decision-makers with no conservation mindset. I highlight major obstacles as well as vast opportunities for bear conservation in developing countries. While studies to understand the threats and limiting factors are necessary for effective conservation, research per se is not going to sell conservation. To put bears on the policy agenda in more than an abstract fashion, biologists in developing countries need to be innovators where they provide new ideas and practical solutions, not just biological data.

# The effects of selective logging on sun bears in lowland dipterocarp rainforest of Borneo

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Sun bears (*Helarctos malayanus*) are found across tropical forests in Southeast Asia including Borneo. Due to decades of timber harvesting, about half of the remaining forests in Borneo are selectively logged. Sun bears are found in these selectively logged forests but the level of use and effects from logging remains unknown. We studied the effects of selective logging on sun bears in Ulu Segama Forest Reserve and Danum Valley Conservation Area, Sabah, Malaysian Borneo, by comparing patterns of habitat use and fruit productivity in primary and selectively logged forest. We conducted bear sign surveys along 94 transects from May 2006 - January 2007, and fruit surveys on 6 forest transects from April 2005 - January 2008. We recorded all bear claw marks on trees as well as the ecological conditions along transects. Bear presence was recorded in 75 transects with 29% and 71% of bear claw marks on trees found in primary forest and logged forest respectively. Statistical analysis identified sun bears' preference for lower trail density, lower big tree density, and logged forest. We found fruit production did not differ between the primary and selectively logged forests. The majority of fruit produced in both forest treatments was associated with distinct fruiting episodes. *Ficus* species (Family Moraceae) produced fruits in both forest types all year making them important food resources for sun bears when other fruit is not available. The availability of fruit in selectively logged forests enables sun bears to survive and forage in these areas. Our results suggest that selectively logged forests can provide fruits at densities comparable to primary forests and thus may be useful to sun bears and other wildlife populations. Sustainably managed, selectively logged forests are significantly more valuable for conservation of wildlife populations than forest conversion to plantations.

# Sun bears in India: conservation vs. threats

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Malayan sun bears (*Helarctos malayanus*) remain the least known bear species in the world. We carried out field surveys during 2007-2010 to know the conservation status of sun bear and threats in north-eastern states, India. Informal interviews of villagers living in and around protected areas (PAs) were conducted and 79 trails in Arunachal Pradesh, 29 in Mizoram and 23 in Nagaland were walked to collect information on occurrence of sun bear through direct sightings and indirect evidences.

Out of 1915 respondents, 265 (29.9%), 245 (31.2%) and 69 (28.2%) respondents confirmed the presence of sun bear by direct sighting and indirect evidences in 3 PAs of Arunachal Pradesh, 4 PAs of Mizoram and 2 PAs of Nagaland respectively. Probable occurrence was reported from 3.9%, 7.3% and 8.5% respondents and there were no responses from 66.1%, 61.4% and 63.2% respondents in Arunachal Pradesh, Mizoram and Nagaland respectively. We sighted one sun bear in Mizoram and two in Arunachal Pradesh. While walking on trails, 695, 307 and 183 indirect evidences of sun bear were recorded in Arunachal Pradesh, Mizoram and Nagaland respectively. Overall status of sun bear was found to be low to medium in and around PAs except Dampa and Nandapha tiger reserves where its occurrence was relatively high. Sun bear were found to be protected because of remoteness and inaccessible forest areas and also due to the added protection in tiger reserves. The potential threats for sun bear were habitat destruction and fragmentation. The extent of poaching of sun bear and black bear for illegal trade was high. We recorded 11 sun bear poaching cases in Arunachal Pradesh, 5 in Mizoram and 7 in Nagaland. Recommendations for threats and conservation of bear species have been made.

# Conservation and research status of brown bear from 2008 to 2011 in Nepal

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Brown bears (*Ursus arctos*) were once known to exist in both Nepal and Bhutan, but current information on their numbers and distributions is lacking. We started our brown bear research and conservation activities from Manasalu Conservation Area in 2008 then after extended in Annapurna Conservation Area and its corridors. We document the presence of brown bear (*Ursus arctos*) in Nepal using field survey and interviews with local people. We were able to confirm the existence of a remnant population in the Manasalu Conservation Area, Annapurna Conservation Area and corridors between Shy Phoksundo National Parks and ACA based on finding scat and digs for Himalayan marmots (*Marmota himalayana*). Based on field survey we found brown bear from 4100 to 5500m altitude and distributed in potential habitat of 4509 km<sup>2</sup>. Dietary analysis showed that main prey species was Himalayan Marmot (26%) and only 11% of diet of brown bear covered by plants. Interviews with local herders also indicated that livestock losses due to brown bear predation amounted to approximately US\$ 5000 in Manasalu Conservation and Annapurna region.

Based on our research we organized National Workshop with Community based People for preparing community based conservation action plan in 2010 January. And then started to review by the bears scientists and finally our activities were endorsed by government of Nepal and now we are jointly finalizing the national action plan for brown bear, brown bear action plan will be released after the workshop in January 2011.



# Status of sloth bears in north Gujarat, India and their conservation opportunities

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Sloth bear (*Melursus ursinus*) population is patchily distributed into two wildlife sanctuaries and other unprotected forests in north Gujarat. The present work has been started since 2007 to congregate with the goal of IUCN Bear Specialist Group to study the distribution and map sloth bear range in Gujarat. We studied the bear distribution through occupancy survey as well as using the knowledge of local people about presence and absence of bear in the area. We organized a sign survey in all the forest patches of the north Gujarat on the 1:50000 map. The area and neighboring villages were also surveyed to know the frequency of bear attack on humans. Local villagers were interviewed using a questionnaire to assess their perceptions of bear in the area. This information collected through questionnaire have been mapped on the digital land use coverage to evaluate the spatial distribution of available bear habitat in the area and the areas occupied by the bears. We found that bears are patchily distributed throughout the region in all kind of habitats; both protected and unprotected forests are occupied by the bears. The bears are also found frequently visiting the villages in vicinity of protected areas. The study reveals that majority of bear attacks occurred in unprotected forests. High human population in adjacent villages, rapid agricultural expansion, continuous encroachment of wildlife habitat, high anthropogenic pressure and lack of awareness are identified as main threats to the bear population. These factors have resulted in escalating bear-human conflicts in the region. Using these key findings, we suggested several measures to local stakeholders and forest authorities to minimize bear-human conflicts, enhance bear habitats and initiated research, monitoring and conservation of bears in the region. Among all, awareness campaigns and workshops for local villagers to mitigate the conflicts proved very effective.

# Community engagement, para-biologist training and Andean bear conservation in and around southern Sangay National Park, Ecuador

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Ongoing human-wildlife conflicts threaten the long-term survival of wild Andean bear populations in and around southern Sangay National Park (SNP), Ecuador. In 1992, park officials extended SNP boundaries over public and private lands. Bears frequently encounter people, damage crops and kill livestock but the park has provided little assistance to mitigate these conflicts. Indiscriminate retaliation against bears and clearing of habitat are common landowner responses. Long-term solutions to these conflicts require community engagement, training, and collaborative management.

Since 2007, the Carnivore Coexistence Lab (University of Wisconsin-Madison) has collaborated with Fundación Cordillera Tropical's (Ecuador) Don Oso Program - a holistic, long-term approach toward working with local communities, integrating community-based training and education initiatives with sound scientific research to conserve the Andean bear in this region.

We have pioneered the use of camera traps to study individual Andean bears in Ecuador and following three seasons of fieldwork, we have trained ten community park guards, three members of the FCT staff and fifteen local University of Azuay students in camera trapping. As we better understand bear habitat use, we are working directly with local landowners to better patrol distant cattle pastures with the aim to mitigate local bear-human conflicts. Finally, we are leading an extensive community and school education campaign that uses photos, camera traps, and participatory activities to talk about bear conservation and conflict mitigation. The results of our work are being used to monitor biodiversity conservation in an inchoate payment for the protection of environmental services program.

Our accomplishments include: conflict mitigation workshops and implementation of mitigation techniques on private lands, socioeconomic surveys of communities impacted by conflict, education programs in local schools and communities, and a long-term camera trap project focused on monitoring the bear subpopulation and implementation of a Payment for the Protection of Ecosystem Services program.



SESSION 4:

COLLABORATIVE PROJECTS IN BEAR STUDIES

# Population fragmentation and inter-ecosystem movements of grizzly bears in western Canada and the northern USA

## INVITED TALK

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Population fragmentation compromises population viability, reduces a species ability to respond to climate change, and ultimately reduces biodiversity. We studied the current state and potential causes of fragmentation in grizzly bears over approximately 1,000,000 km<sup>2</sup> of the northern US, and western Canada. Our methods stemmed from genetic analysis of 3040 bears, supplemented with radiotelemetry data from 639 bears. We used 15-locus microsatellite genotypes with measures of genetic distance, Isolation-by-Distance analysis, multi-factorial correspondence analysis (to identify population divisions or fractures with no *a priori* assumption of group membership), and population-assignment methods to detect individual migrants between immediately adjacent areas. These data corroborated observations of inter-area movements from our telemetry database. In northern areas of our study area, we found a spatial genetic pattern of isolation-by-distance and natural fragmentation from the rugged heavily glaciated coast mountains of British Columbia (BC). These results contrasted with the spatial pattern of fragmentation in southern parts of our study area. Near the Canada/USA border area, we found extensive fragmentation that corresponded to settled mountain valleys and major highways. Genetic distances across developed valleys were elevated relative to those across undeveloped valleys in northern BC. Most inter-area movements detected were made by males, with few female migrants identified. North-south movements within mountain ranges were more common than east-west movements across settled mountain valleys separating mountain ranges. Our results identified several relatively distinct subpopulations. Current movement rates do not appear sufficient to consider the subpopulations we identify along the Canada-USA border as one interbreeding unit. Although, in most situations we detected enough male movement to mediate genetic rescue, the current low rate of female movement detected is insufficient to provide a demographic rescue effect between areas in the immediate future. In Alberta, fragmentation corresponded to major east-west highways and most inter-area movements were made by males. Geneflow and movement rates between Alberta and BC were highest across the continental divide in northern and southern areas, while the central region displayed evidence of natural fragmentation associated with extensive glaciers and icefields. Our synthesis results in a map depicting a large regional anthropogenic female-fragmented metapopulation. This non-equilibrium system will likely require appropriate management to avoid local extirpations of the smaller subpopulations.

In our southern study area we compared sex-specific movement rates between adjacent areas to metrics of human use to understand the causes of fragmentation. This area is bisected by human transportation and settlement corridors of varying intensity. We used multiple linear regression and ANOVA to document different responses of female and male bears to disturbance. Although human settlement caused some level of fragmentation of males, females were more susceptible to fragmentation from settlements and traffic. Both sexes appear to have been influenced by human-caused non-hunting mortality. We documented several small subpopulations with male-only immigration, highlighting the importance of investigating sex-specific movements. Without female connectivity, small populations are not viable over the long term. We therefore recommend enhancing female connectivity among fractured areas by securing linkage-zone habitat appropriate for female dispersal or augmenting small populations with females from larger populations.

# One species, two continents, three patterns of growth; brown bears in North America and Europe

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Body size and growth are important life history traits influencing behavioral, anatomical, and physiological traits of an organism and can show considerable variation across a mammals' range of distribution. Several studies compare size, growth, and size dimorphism within the same general geographic area such as a region, political entity (state, country) or even a continent; however few studies compare the same mammal species separated by continents. Evaluating the differences and similarities in life history traits of populations of a species on two continents will help us understand evolutionary pressures a species is exposed to, as well as further our understanding of how and why populations of the same species respond differently to conservation efforts.

We compared male and female brown bears in two populations, one in North America (Alberta/Canada) and one in Europe (Scandinavia), in relation to their age-specific body length and mass, their patterns of growth and size dimorphism, and their determinants of length and mass. The growth curves of mass and length of females in Scandinavia were significantly smaller than in Alberta, however there was no significant difference in the growth curves of males in either area. This resulted in a more pronounced size dimorphism in Scandinavia in comparison to Alberta. Mass and size of both sexes in both areas generally was negatively related to population density and positively related to environmental conditions. Our results indicate that male brown bears in both areas maximize growth, as expected from life history theory. Female brown bears in Scandinavia seem to trade body size for reproduction, which is indicated by their earlier age of primiparity and larger mean litter size, whereas females in Alberta invest into growth longer, start reproducing later, and have a smaller mean litter size. These differences may be related to the different status of the populations (increasing in Scandinavia, stable or decreasing in Alberta), and effects of the long-term human pressure on the European population.

# Polar bears are seasonally motivated to discriminate conspecific sex and reproductive status via pedal scent

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As a largely solitary and wide-ranging species, we hypothesized that the polar bear (*Ursus maritimus*) uses scent signaling for intraspecific communication. Other bear species have been observed to mark or body-rub on vertical substrate, such as trees or rocks, and an anal scent gland has been identified in several bear species. In contrast, no overt marking behavior has been observed in the polar bear, and its sea ice habitat is lacking any predictably occurring vertical substrate. However, the presence of enlarged and profuse apocrine glands in the skin of polar bear paws, coupled with observations of polar bears investigating the paw prints of conspecifics, suggest that scent deposition is accomplished passively while the bears walk, and that the polar bear's paw is the primary source of deposited scent. We also hypothesized that interest in conspecific scent would be heightened during the spring breeding season. We tested these hypotheses using a classic scent-discrimination experiment, specifically investigating the capacity for polar bears to differentiate between sex and reproductive condition. Pedal scents samples, collected from free-ranging bears (from the Southern Beaufort and Chukchi Seas), were presented to 24 bears in 10 North American zoos. We looked at chemosensory behaviors in subject polar bears, including flehmen, which facilitates the transfer of pheromones to the vomeronasal organ. We found that both males and females discriminated between conspecific pedal scent during the breeding season, showing a significant increase in flehmen while investigating scent of the opposite sex ( $p < 0.02$ ). Males also discriminated between estrous and non-estrous females ( $p < 0.05$ ), displaying a higher rate of flehmen to estrous females. Flehmen behavior was reduced during the fall, non-breeding season, and discrimination of sex and reproductive condition was absent. Our results demonstrate that pedal scent may play an important role in polar bear communication.

# How well can we use photographs to identify Andean bears, assess their kinship, and estimate their ages?

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Using camera traps in population estimation requires reliable identification of individuals. It has been said that individual Andean bears can be identified from their markings, but there has been virtually no assessment of this methodology. We therefore asked, how well can humans recognize individual Andean bears? We also asked two tangential questions: Do perceived similarities in markings reflect kinship? Does the coloration of a bear's nose reflect its age?

We used an online survey of 65 photographs of 39 known-age bears to collect information from 128 people of varied backgrounds. Participants classified each of 21 pairs of images as being from the same bear or from different bears. Surprisingly, participants performed no better than expected at random: the average proportion of correct responses was  $0.49 \pm 0.13$  SD (0.18-0.80,  $n=128$ ).

Other research suggests that experience sometimes improves human ability to identify individual animals. However, neither working with any bear species ( $n=30$  participants) or with Andean bears ( $n=11$  participants) improved performance ( $df=127$ ,  $F=0.51$ ,  $p=0.48$ ;  $df=127$ ,  $F=0.13$ ,  $p=0.72$ , respectively). Performance was also not improved through experience identifying individual animals (74 participants;  $df=127$ ,  $F=0.42$ ,  $p=0.52$ ).

Across 109 participants and 11 pairs of photos, there was no relationship between the pedigree kinship of the bears and their perceived visual similarity ( $df=1173$ ,  $R^2=0.0004$ ,  $F=0.51$ ,  $p=0.475$ ). Thus, it would be misleading to infer that bears with similar markings are closely related.

We estimated the proportion of the nose that was lightly pigmented in 55 photos of 29 bears, from 2.2 months to 36 years old. We saw no light pigmentation in the noses of bears  $\leq 9.9$  years old, but among older bears there was a relationship between age and the proportion of light pigmentation ( $df=22$ ,  $R^2=0.42$ ,  $F=15.16$ ,  $p<0.01$ ). However, this relationship may be of limited utility in wild populations, where the majority of bears may survive  $<10$  years.



# Is it ethical to capture brown bear offspring?

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In conducting field research, biologists are ethically bound by the principle that methods employed should cause minimal harm to the animal studied. Adherence to the principle is a fundamental requirement by national, academic, or wildlife management agencies when permits are issued for handling of animals in the field and is usually a condition of publishing in scientific journals. Research designed to determine demographic parameters, characteristics of age-specific natural mortality and survival, population growth or sustainable yield must evaluate whether the act of conducting the research may bias results, especially when findings are applied to threatened or at-risk populations. We assess the effect of capturing cub, yearling or 2-year-old offspring of brown bears on the increased potential risk of abandonment or mortality of offspring. We monitored the survival of 637 litters from 272 radio-collared female brown bears. These included offspring from 384 litters produced by 128 females in Scandinavia and 253 litters produced by 144 females in interior and northern Alaska. In Scandinavia, where brown bear offspring are weaned as yearlings, all monitored offspring were captured only as yearlings. In Alaska, where brown bear offspring are usually weaned as 2- or 3-year-olds and very rarely as yearlings, we monitored survival of over 52 offspring that were captured as cubs from 23 litters, as well as those captured as yearlings or 2-year-olds. Survival of those offspring was compared to those not captured but accompanied by their mothers. These comparisons are useful in determining whether capture and handling of offspring causes increased mortality and results in biased population assessment. We use these measures to assess whether the value of data collected by capturing cubs or older offspring of brown bears can be ethically justified.

## SESSION 5:

# ECOLOGY AND BEHAVIOUR OF POLAR BEARS

# Interrelationships between polar bears, seals, sea ice and climate in northern Labrador and Davis Strait

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The Davis Strait (DS) subpopulation of polar bears (*Ursus maritimus*) is primarily shared between Labrador, Québec, and Nunavut. Besides ringed (*Phoca hispida*) and bearded seals (*Erignathus barbatus*), which comprise the main diet of polar bears throughout most of their range, bears in DS also prey upon harbour seals (*Phoca vitulina*), harp seals (*Pagophilus groenlandicus*), hooded seals (*Cystophora cristata*), belugas (*Delphinapterus leucas*), and walrus (*Odobenus rosmarus rosmarus*). Harp seal numbers increased from just under 2M in the early 1970s to over about 5.5M by the mid-1990s which correlates with a substantial increase in the DS polar bear population although quantification of their numbers is less well documented. Satellite tracking of polar bears and harp seals, in relation to breakup and freeze-up patterns of the sea ice, confirmed sufficient overlap in winter and spring to indicate that harp seals were vulnerable to significant predation. The average annual home range size for female polar bears was  $118,368 \pm 22,309 \text{ km}^2$  (mean  $\pm$  SE) and ranged from 2,015- 416,451  $\text{km}^2$ . Significant differences in space use strategies were partially explained by differences in diets of individual bears. Those with large home ranges including offshore areas had a higher proportion of harp seals in their diets than did bears with smaller home ranges nearer the coast, which fed more on ringed seals. The harp seal population is no longer increasing and there is now a trend toward reduced duration of sea ice in Davis Strait because of climate warming. These factors may combine to negatively effect the polar bear population, indicating the sensitivity of the relationship between polar bear space use strategies, the potential availability of different prey species, and sea ice dynamics.

# Population ecology of polar bears in Davis Strait, Canada and Greenland

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Until recently, the variability of sea ice habitat for polar bears was considered cyclical or random. As a result, large-scale dynamics of polar bear populations have been thought to be largely a function of harvest pressure. It is now apparent that populations are also influenced by progressive change in the environment; it is necessary to incorporate environmental variables in assessing the status of polar bear populations. We analyzed 35 years of data (2,529 capture and 145 recovery events of 1,860 bears) from the polar bear population in Davis Strait (DS; Canada and Greenland), including data from a new capture effort (2005–2007), to quantify current demography, and to assess effects of environmental variables (prey density, harvest and ice conditions) on demography. We estimated the population size of polar bears to be  $2,158 \pm 180$  (SE), a likely increase from the 1970s, resulting in a highly dense population ( $\sim 5.1$  bears/1,000 km<sup>2</sup> of sea ice habitat). We detected variation in survival (point estimates of  $S_N$  of adult females, 0.943–0.956) and recruitment between geographic sub-regions of DS, which differ in harvest rates and prey density. Survival and reproduction of bears in southern DS (cub litter size,  $1.71 \pm 0.10$ ) was greater than in northern DS ( $1.33 \pm 0.09$ ). Low recruitment rates (litter production rate,  $0.44 \pm 0.62$  and size,  $1.48 \pm 0.08$ , the lowest reported for any polar bear population) may reflect density effects (possibly exacerbated by deteriorating ice conditions). While we found no effect of ice on polar bear survival, we suggest the increase in harp seals (*Phoca groenlandica*), and a decline in harvest rate, have mitigated the negative effects of ice loss. The level of reported harvest is being sustained ( $\lambda_t = 1.00 \pm 0.01$ ), but the population is no longer increasing.

# Multi scale assessment of polar bear habitat in seasonal sea ice, Foxe Basin, Nunavut

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Sea ice extent, thickness and duration have been declining. The effects of changing habitat availability, changing sea ice phenology and increasing habitat fragmentation on ice dependent species are of increasing concern. The polar bear (*Ursus maritimus*), an ice dependent species, will experience the greatest impacts of climate change in seasonal sea ice habitats of Davis Strait, Baffin Bay, Hudson Bay, and Foxe Basin. To date, studies of polar bear sea ice habitat have focused on coarse (regional) scale analyses and high Arctic areas. Our research has advanced the understanding of polar bear sea ice habitat by taking multi-scale approach. We report on coarse and fine (local) scale habitat availability and selection.

We studied habitat fragmentation at a coarse scale (25 km<sup>2</sup> resolution) using SSM/I satellite imagery (1979-2008) and Fragstats software. We found an overall decline of preferred sea ice habitat in Foxe Basin and increasing habitat fragmentation in fall and spring. Our second coarse scale (~ 35 km<sup>2</sup> resolution) analysis, using the Canadian Ice Service ice maps, with time coincident polar bear movement data (2007-2010) showed that polar bears preferred habitat of >90% sea ice concentration, mid to vast size ice floes (0.1–10 km) and a mix of ice thicknesses depending on season. To understand sea ice conditions at the scale of a bear location we used SAR satellite imagery and time coincident polar bear movement data (2008-2010). SAR provides fine scale (75 m<sup>2</sup>) resolution, a scale that allows identification of important sea ice features, such as, leads, polynyas, and ice floes. Preliminary analysis showed that polar bears prefer a mid level of habitat complexity. SAR imagery provides insight into polar bear sea ice habitat requirements that are hidden within the resolution of SSM/I imagery and sea ice maps.

# Individual dietary specialization in polar bears

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Individual-level foraging patterns can have important consequences for ecosystem functioning, wildlife population dynamics, and conservation ecology. However, the diets of individual animals may be difficult to assess because analyses of recent food intake may misrepresent foraging variability within a heterogeneous environment. We used quantitative fatty acid signature analysis (QFASA) to examine the individual foraging patterns of 64 polar bears (*Ursus maritimus*) sampled longitudinally in Western and Southern Hudson Bay between 1994-2003. Estimated diets varied between and within age and sex classes, with adult male polar bears consuming more bearded seal (*Erignathus barbatus*) than adult females or subadult bears, whose diets were dominated by ringed seal (*Pusa hispida*). Among individual adult males, consumption of bearded seal accounted for 0-98% of the diet and bearded seal consumption was positively correlated with individual dietary specialization, as measured by proportional similarity (*PSi*) to the population. Most individual diets were consistent from year-to-year and were therefore not a product of short-term heterogeneity in prey distribution. However, a novel index of longitudinal dietary change indicated that adult male polar bears had the most temporally variable diets with 23% of adult males switching their diet from predominantly ringed seal to predominantly bearded seal or vice versa. We conclude that QFASA is well-suited to analyses of individual-level foraging because it reflects an animal's diet over the preceding weeks to months. The bears in this study were near the southern limit of their species range and the Western Hudson Bay subpopulation is declining because of climate warming. The tightly constrained diets of adult female and subadult bears may make them particularly sensitive to future changes in prey availability. Further investigation of factors influencing prey selection and the impacts of individual foraging on polar bear fitness would facilitate the development of predictive models of the demographic impacts of climate change.

# Long-distance swimming events by adult female polar bears in the Beaufort and Chukchi seas

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Polar bears (*Ursus maritimus*) are dependent on sea ice for their survival and reductions in sea ice have been linked to population declines. In the Beaufort and Chukchi seas, the duration between melt and freeze onset has increased and summertime sea ice extent has decreased. As summer ice habitats melt in this region, polar bears that do not follow the receding pack ice may be forced to swim long distances to areas of higher sea ice concentration or to land. We used data from 52 Global Positioning System collars deployed on adult female polar bears between 2004 and 2009, in combination with satellite imagery of sea ice, to identify swimming events >50 km. During summer and autumn (June through October) we identified 51 swimming events from 20 polar bears. Swimming duration and distances traveled ranged from 0.7 to 12.7 days (mean: 4.1 days) and 51.8 to 660.6 km (mean: 167.0 km). Most bears swam from areas of low concentration sea ice to higher concentration sea ice (mean distance: 171.8 km; n=28). Five bears swam from sea ice to land (mean distance: 160.4 km), while 8 bears swam from land to sea ice (mean distance: 210.3 km). Average movement rates during swimming (2.04 km/hr) were 1.7 times higher than walking (1.19 km/hr) during similar periods. We identified 6 bears whose dependent cubs survived long distance swimming events and 5 bears that may have lost their cubs as a consequence of swimming. Despite the ability of polar bears to swim long distances, this behavior places them at risk of drowning and imposes greater energy expenditure, which potentially has negative impacts on recruitment. Long distance swimming is likely an additional indicator of the negative effects of sea ice loss on polar bears in the Beaufort and Chukchi seas.

# Polar bear politics, ecology, and conservation in Canada

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Few species have generated such polarized perspectives on their status as the polar bear (*Ursus maritimus*). Some studies have contorted their life history and suggested that polar bears will adapt to global warming. Principles of competitive exclusion theory (the Arctic terrestrial ursid niche is already filled by brown bears (*U. arctos*)), ideal free distribution, habitat trends, and energetics yield far differing insights. As a species almost totally reliant on sea ice habitat and marine resources for energy, the long-term likelihood of polar bear persistence in an area is inextricably linked to the fate of sea ice. With global declines in sea ice, there is robust support from many studies indicating population declines coincident with declines in ice-cover and duration. When ice conditions were non-declining, projection models provided a means of estimating future population sizes from current estimates of survival and reproduction. Under declining conditions, however, survival and reproduction are projected to change, and population size projections into the future must therefore rely on establishing the mechanisms of change so that survival and reproduction (and thus population sizes) can be predicted from existing data for future conditions. Despite the seemingly dire conservation status for this species, monitoring and research in Canada remain inadequate and few concrete actions have been taken to aid polar bear conservation outside of the provinces of Manitoba, Ontario, and Newfoundland and Labrador where the bears have been assigned “threatened” status. Nationally, Canada’s Committee on the Status of Endangered Wildlife in Canada has proposed a lower status of “special concern” due to a failure to address sea ice loss and further obscured conservation action by considering all polar bears as one conservation unit. Polar bears in Canada span over 3000 km north to south and different populations are exposed to vastly different ecological conditions rendering a single designation ineffective.





## SESSION 6:

# ABORIGINAL AND TRADITIONAL KNOWLEDGE OF BEARS

# Grizzly bears as the umbrella species for the St'at'imc First Nation culture

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Grizzly bears (*Ursus arctos*) have long been recognized as indicators of healthy and functioning ecosystems. The St'at'imc First Nation in southwest British Columbia, Canada, has demonstrated that the grizzly bear is also an umbrella species for their culture. Comparing the traditionally used food and medicine plants of the St'at'imc to dietary information of grizzly bears obtained from GPS collared animals, the overlap is significant. The spiritual role of the grizzly bear in the culture is also captured in the teachings, art, and dance. The problem, however, is that grizzly bear populations throughout southwest BC are threatened and show signs of severe genetic isolation. This is seen as a warning sign of overall ecosystem decline, and the St'at'imc are taking action to protect their culture and heritage on the landscape by recovering the grizzly bear populations. This work includes plans to re-establish traditional practices like controlled burning and tending of herbaceous meadows, teaching the scientific and traditional knowledge to students enrolled in the St'at'imc Education Institute, and developing guidelines for stakeholders working in the territory such that bears and their habitats are protected. Healthy, functioning, connected ecosystems are essential for the long term viability of both the grizzly bear and the St'at'imc culture.

# Significance of Mashiramo (*Tremarctos ornatus*) to the Yupka's communities in the Colombian Serranía Del Perijá

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Mashiramo is the name of Andean Bear in Yupka language. This community came from Venezuela through the Serranía del Perijá, occupied the warm plains of Cesar's valley. With the Spanish's arrival, the Yupka have been forced to inhabit the highlands of Perijá. Since 1950, due to cotton and marijuana's prosperity, this community lost definitely their territory and changed their semi-nomad life style for a sedentary one, in addition to vegetal coverage's lost and other social external issues, the community's traditional relationship with the environmental was modified until almost disappear.

In 2009, by semi-structured interviews, informal chats, and knowledge's exchange, it was collected indigenous perceptions and attitudes towards Andean bear, as the Yupka's mythological signifiers which determine the current relation Bear-people. Based on that, is possible think that Bear still have a huge symbolic relevance. In earliest times, the Andean Bear was considered a person, he spoke, picked firewood, had cultivation area and fireplaces. The Andean Bear's nests, symbolic and ethologically, are comparable with people's fireplace, owing the fact that Bears accumulate seeds and vegetal remains of consumed plants, like the people prepare and eat food around the fireplaces. Two aspects that reflect the transcendence of bear-Yupka relationship are the origin of Preys and dance of Maíz Cariaco, or dance of Mish, harvest's celebration which involve Bear hunting, to make "bollos preñados", typical meals which represented the Sow and Harvest, resurgence and order.

Nevertheless, in current times Andean bears don't come to Perijá. According to elders, that is because of the young people don't sign to bear in the hunt. And they don't sing because the dramatic cultural change happened to their communities. Actually the Yupka-Bear relationship is a consumption one; this due to the bear meal constitute main animal's protein source. Even the schools are ethno-educational, none of them promote the continuity and recuperation of Yupka's traditional practices.

# Cree understanding of wabusk: documenting traditional knowledge of polar bears in the Hudson Bay Lowlands of Ontario

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## Objectives

Few people recognize that the Cree (or the *Muskegowuck Athinuwick*) of the Hudson Bay Lowlands have interacted with the polar bear (*Wabusk*, *Ursus maritimus*) for centuries. As a people exploiting a ecological transition zone between the boreal forest and tundra, as well as the muskeg and the coast, the *Muskegowuck Athinuwick* have a considerable store of traditional knowledge about an environment relatively little explored by science. Presented next are the results of a collaborative research project between the First Nations of Washaho and Weenusk, the Keewaytinook Okimakanak Research Institute (KORI), and the Centre for Northern Studies at Lakehead University. The goal of the project was to acquire a greater understanding of Cree knowledge regarding *wabusk* (polar bear), document human-polar bear interactions in the territories of the Weenusk and Washaho Cree nations of Ontario, and emphasize the political aspects of knowledge production. This presentation discusses the key findings and recommendations from the study.

## Methods

Through collaborative studies aimed at recording *Kiskayndamowin*/Cree Knowledge, we have since 2006, conducted over 46 interviews with Elders' and hunters' experiences with polar bears along the Hudson Bay coast of Northern Ontario.

## Results

Cree knowledge agrees with much information previously published in the scientific literature and adds to it, for example through observations of polar bears preying on beavers, interacting with black bears, and travelling greater distances into the muskeg than previously recorded. Our research suggests that traditional knowledge can serve as a qualitative check on scientific information and extend the recorded knowledge of polar bears.

# Do grizzly bears eat mountain sheep? A search for evidence in a northern alpine ecosystem

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Grizzly bears (*Ursus arctos*) may exhibit varying degrees of carnivory depending on various factors, including body mass, litter size, population density, and prey availability. To assess whether grizzly bears in the Richardson Mountains, Canada, prey and feed on a Dall sheep (*Ovis dalli dalli*) population, we investigated the habitat use and home range overlap of the two populations, the  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  stable isotope ratios of grizzly bears and several food sources, and interviewed 23 Gwich'in and Inuvialuit elders and harvesters on their traditional ecological knowledge. Spatial analyses revealed a substantial overlap between the two populations, with a third of core areas intensively used by Dall sheep also used intensively by 6 of the 15 collared grizzly bears. Stable isotope analyses support the hypothesis that grizzly bears in the area have a high level of carnivory, although other prey like moose (*Alces alces*) and caribou (*Rangifer tarandus*) have an isotopic signature close to Dall sheep; so the species consumed may not be distinguished without further analyses. Knowledge shared by Gwich'in and Inuvialuit interviewees bring mixed evidence and varied among them. Some participants mentioned that Dall sheep are hard to catch and believed grizzly bears rather feed on berries, arctic ground squirrels (*Spermophilus parryi*), and fish. Other participants were convinced that the bears commonly rely on Dall sheep and reported events of both scavenging and predation. Based on the carnivory level of grizzly bears in this ecosystem, on their overlap with Dall sheep home range, and on testimonies by aboriginal interviewees, our research supports the premise that Dall sheep are indeed part of the grizzly bears' diet.

# Combining Inuit ecological knowledge and western science in wildlife governance: the case of polar bear co-management in Nunavut

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Given the significance of polar bears for both northern aboriginal people and the global public, there has been growing support for the complementary use of both traditional ecological knowledge (TEK) and scientific information in polar bear research and management, especially in Canada. While collaborative attempts using both science and aboriginal TEK in wildlife governance have extended over the years, the acceptance of their combined use remains contentious.

Drawing theoretical insights from the disciplines of ecological anthropology and science and technology studies, we review research and management initiatives that have sought to combine Inuit TEK and scientific information for managing polar bears in Nunavut, Canada. We aim to (1) advance understanding of the challenges and opportunities posed by such an approach; (2) identify potential areas of convergence between scientific expertise and Inuit TEK; and (3) explore mutually affirming ways in which resource users, biologists, and policy-makers can work together.

Based on interviews conducted with Inuit, biologists and wildlife managers over the course of 10 months of field research, we argue that while Inuit can bring significant contributions to polar bear governance, the process of integrating Inuit TEK and western scientific knowledge in co-management in Nunavut has faced numerous challenges, including: (1) a lack of transparency and communication between local, scientific and managerial communities regarding the strengths and limitations of TEK and scientific knowledge; (2) the challenge of finding culturally relevant ways of assessing the validity of knowledge rooted in multiple cultural traditions; and (3) the existence of mistrust and power struggles among stakeholders, which hinders the building of collaborative research and management.

We suggest that neither science nor TEK is sufficient in isolation for understanding the complexities of polar bear ecology, especially in the context of climate change. We explore ways in which such perspectives can enter a constructive dialogue.

SESSION 7:

BEAR BEHAVIOUR



# Seasonality of reproduction in wild spectacled bears in the dry forest of Cerro Venado, Peru

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Many fundamental aspects of the life history of spectacled bears (*Tremarctos ursinus*), including timing of reproduction, remain unknown. The dry forest of north coastal Peru provides a unique opportunity for observational study, and from 2007-2010 we observed wild spectacled bears year-round. From February to early December, we never observed adult bears within  $\leq 10$  meters of one another, however, from mid-December to late January we observed 7 different pairings of adult bears, involving 14 different individuals. 7 pairs were observed  $\leq 10$  meters apart for  $\geq 2$  days and, in one case, for 6 days. During this period we documented aggressive vocalizations not heard at other times of year on 18 occasions, and in 2010 we observed 3 pairs of bears breeding. Thus, mating in this population appears to occur from mid-December to late January. In 2009-2010 we discovered 4 active maternal den sites. At the time of discovery each den contained a single cub, none of which was yet able to walk. Data from captive bears suggest that these cubs were  $\leq 30$  days old, placing their birth dates between early and late September. These observations suggest a gestation period of approximately 240 days, consistent with several other bear species. To our knowledge, these are the first observations of mating and denning in this species in the wild, with the exception of a natal den discovered in 2010 in Ecuador's cloud forest. That den contained a newborn cub in March, suggesting that timing of reproductive events may be keyed to local cues, rather than genetic or circannual patterns. Bears at Cerro Venado forage heavily and almost exclusively on sapote fruit when it is available from December to May, and we suspect that timing of bear reproduction may be closely linked to availability of this key fruit.

# Whistles and slingshots increase the wariness of American black bears

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In British Columbia, bear managers kill approximately 800 black bears and 35 grizzly bears annually because of conflicts with humans. Agencies are under increasing pressure to manage non-lethally, typically using aversive conditioning (AC). We tested two novel techniques intended to increase the efficacy and practicality of AC by alternately assigning 19 black bears in conflict to one of three treatment groups: one that paired pain with sound (whistles), one with pain alone, and a control group. Whistles were used to signal pain delivery because such an association could subsequently be used to dissuade bears temporarily from attractants to prevent the food conditioning that leads to conflict. Our second innovation was to induce pain with marbles fired from sling shots, which we compared to rubber bullets fired from shotguns. Bears quickly associated whistles and pain and were as likely to run from marbles as from rubber bullets. After conditioning, treated bears were significantly more wary than control. Our results suggest that AC practicality and efficacy might be increased by exploiting a sound-pain association and by using a non-registered form of projectile to increase the number of people, and hence frequency, with which bears in conflict could be treated.

# Evidence for conspecific cueing in guiding landscape-level movements of American black bears in northcentral Minnesota

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Bears are known for their ability to find their way to and from concentrated food sources that are sometimes far from their normal summer home range. How they do this is not understood, though excellent navigational skills, memory, and olfaction undoubtedly play a key role. The influence of social learning in establishing travel patterns has rarely been considered, except for anecdotal evidence that bears sometimes revisit locations visited as cubs with their mothers. We examined attributes of seasonal movements of American black bears (*Ursus americanus*) in northcentral Minnesota, including timing, direction, distance, prevailing food conditions, and ultimate destination, and we documented the development of movement patterns in individual bears as they matured. We monitored the movements of >200 radio-collared bears over a period of 10 years, and observed 2 distinct types of seasonal migrations, during which bears traveled alone but in the same direction, and later returned: 1) ~40% of bears migrated, typically southward, up to 168 km in late summer to find concentrated sources of foods; 2) ~20% of males moved 12-144 km during fall to overwinter in an expansive peatland landscape well north of their summer ranges, returning to summer home ranges the following spring. Late summer foraging destinations were typically not related to locations bears visited with their mothers. Long-distance travel to dens was also not learned from mothers, as this behavior (unusual in other bear populations) was almost unique to males. Bears showed a degree of coordination in their travel destinations that suggested a role for conspecific cueing in guiding the movements of individuals each year. We examine the hypothesis that keystone individuals and landscape-level travel networks explain some of the seemingly coordinated movement patterns observed in this solitary species. We revisit historic accounts of bear migrations in the context of these ideas.

# Grizzly bear and black bear marking behavior

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Marking activity is common among ursids but relatively little information has been quantified about this nearly ubiquitous behavior. Here, we describe marking behavior of sympatric grizzly bear (*Ursus arctos*) and black bear (*U. americanus*) populations in a 31,400 km<sup>2</sup> area in northwestern Montana, USA. We found marking activity in all areas occupied by bears regardless of bear density and land use. Based on identification and examination of >5,000 bear marking sites 1998-2009, rubbing was the most common behavior as evidenced by the presence of bear hair. We made repeated visits to collect hair and used genetic analysis to identify the species, sex, and individual identity of the bears using rubs. Many rubs were used by both grizzly bears and black bears. Bears most commonly marked trees (86%) but sign posts on hiking trails and forest roads, power poles, and fence posts were also used. Only male hair was found at bear rubs in May and June but female use increased substantially by late summer. While cubs were detected at lower rates than older age classes, all grizzly bear sex and age classes participated in rubbing. Other bear activity observed at bear rubs included: clawing (54% of rubs), biting (45%), and bear trails (29%). Many sites were rubbed repeatedly within and between years but there was also continual turnover. Using remotely triggered cameras, we documented bears urinating at rub sites and occasionally sniffing trees before, during, and after rubbing. This supports the idea that one function of marking is chemical communication among bears, although this behavior is distinctly different from marking behavior observed in territorial species. With the high frequency of rubbing activity, hair from bear rubs provides a reliable and efficient way to concurrently sample these sympatric populations to estimate abundance and monitor trends.

# Intraspecific relationships between brown bears, Asiatic black bears and the Amur tiger

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In the Russian Far East, the Amur tiger (*Panthera tigris altaica*), brown bear (*Ursus arctos*) and Asiatic black bear (*U. thibetanus*) all share the same habitat. These three species all prefer deciduous and mixed wood forests. In the Sikhote-Alin protected area, the relationship between bears and a tiger were studied during extensive telemetry research in the region. During the non-denning period bears scavenged 16.7% of surveyed tiger kills (n=427). Brown bears scavenged tiger kills 6.7 times more often, than Asiatic black bears. The frequency of autumn scavenging by bears was less than spring ( $X^2 = 8.7$ ,  $df = 1$ ,  $p = 0.003$ ) and summer ( $X^2 = 10.5$ ,  $df = 1$ ,  $p = 0.012$ ). In 44.4% of cases the bears scavenged tiger kills only after the tiger had abandoned the kill site. In at least 4 cases (11.1 %) bears displaced tigers from a kill, while in 4 cases both tigers and bears utilized the kill during the same period. Analysis has shown that 2.1% of bears diet is obtained from tiger kills, 1.4% for brown bears and 0.7% from Asiatic black bears. In 44 recorded encounters between tigers and bears, the tiger initiated contact in 12 cases while the bear initiated contact in 8 cases. Of these encounters, 50% resulted in the death of the bear, 27.3% resulted in the death of the tiger and in 22.7% of encounters both animals survived and parted ways. Records of tigers killing Asiatic black bears are unclear. Tigers can prey on denning bears, and the Asiatic black bear have better protected dens than brown bears. Bears often follow tiger tracks through deep snow for ease of movement, to scavenge tiger kills and to potentially prey on tigers. Tigers, brown bears and Asiatic black bears all use the same mark and rub trees.

# The noble cat and the big bad scavenger: the effects of kleptoparasitism by brown bears on Eurasian lynx

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Use of carrion by facultative scavengers is an important, yet poorly understood and underrated ecological process. It includes scavenging on prey remains of large predators, an interaction known as kleptoparasitism. In temperate and boreal regions, the bears might be the most important mammalian kleptoparasites. They are efficient scavengers with an acute sense of smell and of large size, which helps them to displace predators from their kills and to consume majority of the edible biomass relatively quickly. Several authors speculated about possible effects that bear kleptoparasitism could have on the prey utilization and on the predation rates of predators. However, so far there is almost no empirical data available. We studied the effects of kleptoparasitism of brown bears (*Ursus arctos*) on the consumption of prey and the predation rate of the Eurasian lynx (*Lynx lynx*) by using GPS-GSM telemetry in combination with inspection of kill sites and automatic video surveillance of prey remains. Eurasian lynx is a solitary felid that hunts large prey, mainly ungulates. A prolonged consumption process (usually 3-5 days) makes Eurasian lynx highly susceptible to scavengers and thus a good example for studying the effects of kleptoparasitism. Our study took place in Northern Dinaric Mountains, one of the few regions in Europe where Eurasian lynx and brown bears still coexist today. Bears found approximately one third of all ungulates killed by the lynx (n=66) and significantly reduced lynx prey utilization (41 % per prey). Lynx responded by increasing predation rate and thus managed to partially compensate for losses due to bear kleptoparasitism. Video clips of consumption of lynx prey and lynx anti-scavenging behavior will also be presented, as well examples of effects of presence of ungulate carcasses on bear movements and active tracking of lynx by the bear.



SESSION 8:

PHYSIOLOGY OF BEARS



# Non-invasive monitoring of ovarian function in polar bears (*Ursus maritimus*) by measuring fecal steroid metabolites

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Little is known of hormonal events associated with the polar bear estrous cycle. In order to develop tools for the study of ovarian cyclicity in polar bears, we adapted enzyme immunoassays (EIA), and validated its use in feces from this threatened species. The present study validated measurement of fecal metabolites of sex steroids as a non-invasive method for monitoring ovarian function and elucidating the dynamics of the estrous cycle in polar bears. Fresh fecal samples were collected several times per week from 5 captive female polar bears (4 adult and 1 immature) prior to and throughout the spring mating season. EIAs for 17 $\beta$ -estradiol (E2) and progesterone (P4) were tested both for antibody cross-reactivity, and specificity to steroids in polar bear fecal extracts by examining parallelism to a standard curve. High pressure liquid chromatography (HPLC) was used to detect sex steroids and their metabolites. HPLC verified that conjugated and unconjugated estrogens and pregnanes were abundant in polar bear fecal extracts, and that the EIA antibodies accurately detected estrogen and progesterone within the fecal samples. E2 and P4 EIAs were then validated biologically by comparing longitudinal changes in fecal steroid concentration with concurrent changes in rate of male-female sociosexual behavioral interaction prior to and during the mating season (February-May). Immunoreactive estrogen and pregnane concentrations fluctuated significantly during the mating season in all adult females ( $F = 19.4$ ,  $p < 0.001$ ,  $df=4$ ), but not in the immature female. Moreover, male sexual interest in adult females was strongly associated with changes in the females' fecal estrogen profiles. Collectively, these data indicate that fecal sex steroid metabolites are biologically relevant indicators of ovarian function in polar bears. We conclude that measurement of fecal steroid metabolites can be used to non-invasively monitor progression of the estrous cycle in polar bears.

# Non-invasive fecal hormone monitoring for evaluating polar bear (*Ursus maritimus*) reproductive activity

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Reproductive performance of captive polar bears has been poor with few bears producing cubs and high neonatal mortality experienced by cubs that are born. The ability to monitor reproductive events (estrus and ovulation), characterize seasonal effects on reproduction and diagnose pregnancy could provide valuable information for guiding appropriate animal management and husbandry decisions made by animal caretakers. At CREW, non-invasive fecal hormone assays for testosterone and progesterone metabolites were validated for polar bears in 2007. During the following 3 years, captive polar bears (n=13 male; n=28 female) at North American zoos (n = 19) were monitored, yielding 13 male and 52 female year-long hormone profiles for bears under different management situations (breeding, non-breeding and contracepted). Results indicated that testosterone metabolites increase during the breeding season in both female and male polar bears, and brief spikes in female testosterone are correlated with estrus, and presumably follicular activity. Although a post-ovulatory increase in progestin metabolites was not always measurable, sustained baseline testosterone concentrations appeared to serve as a reliable indicator of ovulation. In contrast, anovulatory bears exhibited spikes in testosterone and were often observed mating again throughout the spring and early summer. Pregnant bears experienced an increase in progestin metabolites in the fall that likely correlated with embryo implantation. However, there was significant individual variation in progestin concentrations produced. Furthermore, many bears exhibited a fall progestin increase without giving birth, suggesting they experienced either pregnancy loss or a pseudopregnancy. Additional tests for differentiating true pregnancy from pseudopregnancy in this species are currently being investigated. Non-invasive fecal hormone monitoring has also proven useful in identifying post-reproductive female bears and for documenting the effects of contraceptives in this species. Because the methodologies are completely non-invasive, they also could be used to monitor wild bears.

# The brown bear as a reverse translational model for human health and disease

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## Background

During hibernation the brown bear (*Ursus arctos*) has strategies to avoid organ damage despite lying still for months in a cold environment without eating or drinking. The objective of this collaborative project is to view the bear as a reverse translational model for human health and disease.

## Project design

The project fulcrum is an intimate collaboration between the Scandinavian Brown Bear Research Project and Örebro University Hospital, Sweden and several other institutions in Scandinavia, Germany and France. Blood and tissue samples are collected from subadult bears in the den each season in February and again, in the same bears, during active state, in June.

## Main focus areas

Cardiovascular function is characterized by assessment of coagulation, oxidative stress, oxygen handling, apoptosis, inflammation and insulin resistance. We also investigate markers of osteoporosis and obesity and we cultivate mesenchymal stem cells from fatty tissue.

## Results

Following a pilot phase the project proper has been running for almost two years. Our findings this far indicate dramatic and statistically significant alterations in platelet function, plasma lipids and neutrophils but not in stem cell function between hibernation and active state.

## Conclusion

It is our hope that this multidisciplinary multicenter approach to brown bear hibernation may serve as an inspiration for research in human physiology and pathophysiology. In addition, we hope it will help us to better understand the physiological adaptations of bears to hibernation, which is an important and vulnerable period of their year.

# Characterization of polyestrus in American black bears, *Ursus americanus*.

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The goal of this project was to elucidate the dynamics of the ursid estrous cycle, using a non-endangered model species, the American black bear. We hypothesized that American black bears are seasonally polyestrus due to successive waves of follicular development and sequential ovulations. Urine was non-invasively sampled twice daily (late May-mid July) in three consecutive years from five adult (non-mated) females trained to urinate on command. Estrogen and progesterone enzyme immunoassays were validated for use in measuring concentrations of steroid metabolites in urine by demonstration of sufficient antibody specificity. Assays were cross-validated by comparison of immunoreactive steroid concentration to changes in vulvar swelling, sociosexual behavior and response to administered gonadotropins. Rapid declines in concentration of urinary estrogens, from peak levels, were significantly associated with peak sociosexual interactions ( $R = -0.43$  to  $-0.51$ , cross-correlation) and vulvar swelling ( $R = -0.36$  to  $-0.37$ ) in unmated females. Vulva score (0-3 rank) was recorded as a composite average subjective rating of vulva visibility, swelling and color. Sociosexual behavior was recorded in unmated females using a composite subjective rating (0-3 rank) of male-female (across fence) and female-female (within pen) interactions. Behavioral estrus (days of observed mating that culminated in ejaculation) and physiologic estrus (vulva score  $\geq 2.5$ ) was documented in an additional 6 adult females that were allowed access to males during a single mating season. Mated females each had 1-4 distinct behavioral estruses (per season) of 1-4 days duration (3-19 days inter-estrus interval). In comparison, these females entered physiologic estrus 1-3 times, lasting 1-10 days (4-9 day inter-estrus interval). Eighty one percent (13/16) of total behavioral estrus days ( $n = 5$  mated females) coincided with physiologic estrus. Collectively, these data clearly indicate that black bears are seasonally polyestrus, and support our hypothesis that successive waves of follicular development are the underlying mechanism.

# The critical role of captive bears in assessing stress in wild Asiatic black bear populations in southwest China

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Asiatic black bears (*Ursus thibetanus*) in China are threatened by diminishing suitable habitat and poaching pressure for gall (used in traditional Chinese medicine) and the protection of crops. We sought to non-invasively assess the stress condition of wild Asiatic black bears in and around nine nature reserves in southwestern China by collecting more than 600 fecal samples in an effort to better understand what landscape variables relate to chronic elevations in stress hormone production in this species. In order to account for variation in stress attributable to sex, season, and social pressures, we ran a series of experiments in captive Asiatic black bears at a bear rehabilitation center operated by the Animals Asia Foundation near Chengdu, China. Through our experiments with captive Asiatic black bears at the rehabilitation facility we were able to determine that seasonal patterns in stress hormone production vary between sexes. For example, competition among males at concentrated food resources during the pre-denning period is a likely source of elevated glucocorticoids in these individuals. We also found that hair samples provide another viable, non-invasive route allowing for retroactive assessment of historical endocrine profiles. We will discuss the application of results from our captive bear work in interpreting data from the study of free-ranging Asiatic black bears.

SESSION 9:

POPULATION ESTIMATION

# Estimating bear populations by spatially explicit capture-recapture

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Animals that are mobile and often hidden by vegetation pose special problems for ecologists and population managers because they cannot be counted directly. Indirect methods using passive detectors (e.g., cameras, hair snares or traps) or searches for sign (e.g., faeces or hair from rub-trees) require statistical manipulation to adjust for incomplete detection and movement of animals over the sampling period. Spatially explicit capture–recapture (SECR) is a growing suite of methods for the analysis of such indirectly acquired data.

The core assumptions of SECR are that each animal has a distinct and more or less consistent pattern of space use (a home range), and that the average probability of detecting an animal at a single detector declines with distance from the range centre, as described by a ‘detection function’. The centres are not known, but it is nevertheless possible to estimate the detection function by maximizing an integrated likelihood or by Bayesian methods. Density may be estimated from the detection function and the number of individuals detected, or by including it in the likelihood to be maximized.

In this talk I will briefly review the general features and benefits of SECR before focussing on two aspects especially relevant to bear research and management. The first concerns the use of SECR to estimate population size rather than population density. The second concerns sampling schemes for the efficient estimation of density or population size over a large region. For this, composite designs comprising disjoint search areas or detector clusters of varying size are especially promising. New features in the R software package ‘secr’ will facilitate the construction, analysis and testing of composite designs.

# Genetic tagging free-ranging black bears and grizzly bears since 1995: implications for population-level studies of bears and other wildlife

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Starting in 1995, we used genetic markers to identify individual black bears (*Ursus americanus*) and grizzly bears (*U. arctos*) in free-ranging populations in southern British Columbia, Canada to improve data reliability in mark-recapture population estimates. Our initial work focused on two areas: design of an effective hair-trap that would provide samples for DNA analysis in large-scale field applications; and, the development of analysis protocols to strengthen the reliability of a suite of microsatellite markers to provide a genetic tag that would dependably identify individual bears. High interest in these techniques amongst bear researchers stimulated a number of workshops and concurrent studies on several species of bears and encouraged the application of DNA-based tags to population-level studies of other taxa. We provide an historical look at the early days of hair-snagging including the role a variety of IBA members played in its genesis. We also observe the contribution that genetic tagging studies of black and grizzly bears have made to research into free-ranging populations of other bear species around the world. The widespread use of this technique is in part due to the networking available through IBA conferences and publications. Genetic tagging methods developed for free-ranging bears also have been creatively modified for use with a variety of other wildlife demonstrating that work by IBA members may influence ecological investigations beyond bears.



# Effects of subsampling genotyped hair samples to estimate black bear abundance

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DNA-based capture-mark-recapture techniques are commonly used to estimate bear population abundance. However, analyzing all collected samples can be cost prohibitive, particularly for high-density populations. Therefore, subsampling is frequently used to reduce genetic analysis costs. Because the effects of subsampling on performance of likelihood-based heterogeneity estimators and information-theoretic model selection methods have not been determined, we used DNA-based capture data for an American black bear (*Ursus americanus*) population in Great Smoky Mountains National Park, Tennessee to investigate the effects of subsampling hair samples on closed-population estimates. We extracted DNA from hair collected at baited barbed-wire enclosures and identified 139 (81 F:58 M) individual bears by their unique 8-microsatellite loci genotypes. We used the full closed-population with heterogeneity data type in Program MARK to estimate capture probabilities and population abundance, and used Akaike's Information Criterion to rank models, model average parameter estimates, and calculate evidence ratios. We examined the effects of subsampling intensity by incrementally reducing the full dataset by 5 samples/period and evaluating the change in parameter estimates, importance of heterogeneity effects, and model selection uncertainty. Based on the full dataset, model-averaged abundance estimates for females and males were 164 (SE = 39.16) and 100 (SE = 21.60), respectively, and the average weekly capture probability was 0.09 for females and 0.12 for males. Estimates of capture probability and population abundance and cumulative weights for heterogeneity models increased as subsampling intensities increased and model selection uncertainty was greatest at intermediate subsampling levels. Our results suggested that, for our study, 40 samples per week produced capture probabilities sufficient to consistently detect heterogeneity in capture probabilities and obtain reliable population estimates. Because undersampling can result in a model selection bias toward non-heterogeneity models and thus negatively biased model-averaged estimates of abundance, determining an appropriate level of subsampling based on pilot studies is crucial.

# Grizzly bear abundance, distribution, connectivity and conservation across the southern coast ranges of British Columbia

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The southwestern fringe of grizzly bear range in North America lies in the southern Coast Mountains of British Columbia. Although there have been dozens of research and monitoring programs towards the southeastern fringe, there has been no study and little known of grizzly bear population status and ecology towards the southwest. This situation was disconcerting given the range of resource demands, large nearby human population, and potential for excessive cumulative impacts. Over a 5-year period, we applied hair-snag and subsequent DNA techniques to systematically sample grizzly bear occurrence across ~40,000 km<sup>2</sup> of potential range. In addition to establishing landscape occupancy, our objectives were to model population density, distribution, and connectivity, and to best explain associated patterns in terms of natural and human factors. Among geographically defined population units, density varied from 0 (extirpated) to 12.7 bears per 1000 km<sup>2</sup>. Tremendous spatial variation in abundance and complex distribution was explained by several surrogates of habitat quality, human influence, and associated dispersion. Among 272 individual bears detected to date, we identified 9 genetically discrete population clusters. Spatial interpolation of cluster assignments indicate ancestral landscapes with little human access separated by historic human activity and physiographic features that are likely to inhibit grizzly bear movement. Several defined groups are no longer entirely panmictic, but gene flow continues to be restricted in some locales. One small group (n=~23) has remained entirely isolated with lower genetic variability than known for any other mainland grizzly bear population in North America. Dramatic genetic drift is apparent between this and an closely adjacent group. For regional population recovery and conservation, our results and spatial outputs are focusing efforts to re-establish and maintain population core, peripheral and linkage landscapes. In particular, the importance of secure source areas in population recovery and expansion to peripheral but connected landscapes is demonstrated.

# Estimating the Asiatic black bear population using different techniques- a case study from Dachigam National Park, Kashmir, India

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The rugged terrain of the Himalaya and the behavior of Asiatic black bear (*Ursus thibetanus*) pose a challenge for biologists and managers in estimating the bear population size. We used a combination of abundance estimation techniques viz., bear sign surveys, capture–recapture techniques (marked bears, non invasive camera trapping and genetic sampling) and home range analysis for estimating the black bear population in Dachigam National Park, Kashmir, India, during the period 2007-2010. We placed a camera trap and a hair snare station in 23 grids (2 x 2 km) of the intensive study area (90 km<sup>2</sup>) and sampled 13 transects/trails (1.5 to 2 km) covering all the grids for bear signs and visual encounters (ca. 900 km efforts). We marked 13 bears using colour-coded collars (n=2), ear tags (n=5), VHF collar (n=1) and satellite collars (n=5). While the abundance estimates from the transect/trail sampling varied from 0.07 to 1.05 bear signs/km, the photo capture rate ranged from 0 to 17.97 captures/100 trap nights. The abundance estimates based on camera trapping and transect/trail sampling were found to be significantly correlated ( $R^2=0.79$ ). The genotyping of the samples (ca. 200 hair and 400 scats) for population estimation is being carried out using 20 microsatellite markers. The density estimates based on mark-recapture techniques (camera trapping and genetic analysis) will be presented and discussed. A comparison of the advantages and limitations of these techniques will be made along with information on possible ways to overcome limitations for future use.

# Density estimation of Asiatic black bear and sun bear using chest marks and photographic capture recapture sampling

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Assessing the recovery and conservation status of threatened species is greatly aided by unbiased estimates of population size as this is often the primary parameter on which to base management decisions. We present a new approach from an experiment that sought to identify individual Asiatic black bears and sun bears, as a prelude to mark-recapture population estimation. Based on a blind experiment with captive animals we concluded that both black bears and sun bears can be individually identified with a high degree of accuracy using their chest marks. The density estimation study was conducted in two sites in mostly primary evergreen forest of Khao Yai National Park of northeastern Thailand. Eighteen bait stations per site were used each with three camera traps mounted on trees facing each other in a triangular arrangement with bait in the center. Photographs were examined for individual identification. In Khlong E-Tao, a 33 km<sup>2</sup> area (Dec-Mar 2010), we recorded a minimum of 13 black bears (8 males, 4 females and 1 unknown sex) and 8 sun bears (1 male, 5 females and 2 unknown sexes). In Khlong Samor Pun 40 km<sup>2</sup> (Mar-May 2010), we observed 10 black bears (6 males and 4 females) and 6 sun bears (4 males and 2 females). Abundance (Mh-jackknife) of bears based on conventional closed population assumptions as well as spatially explicit maximum likelihood methods indicated that our technique can provide reasonably precise estimates of both species. The relative abundance of black bears versus sun bears from this method also appeared to match well with an independent analysis using claw marks on climbed trees.

# Aerial survey estimation of abundance for polar bears during the ice-free season

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In North America, polar bear population assessment has historically relied on physical mark-recapture. While widely accepted in the scientific community, such studies are logistically, financially, and time intensive, and, in Canada, local Inuit have voiced opposition to wildlife handling. Although aerial surveys are widely used in wildlife monitoring, their application to polar bears has been limited. Developing a broader suite of assessment methods will facilitate monitoring throughout the Circumpolar Arctic, as 11 of 19 subpopulations are considered data deficient. Thus, to better reflect Inuit values and enable greater monitoring, we developed and implemented an aerial survey in the Foxe Basin subpopulation during late summer, 2009 and 2010. Foxe Basin, a seasonally ice-free subpopulation, spans some 1.1 million km<sup>2</sup> in Nunavut, Canada. Since polar bears congregate along the coast during late summer, we delineated strata based on proximity to the coastline. We employed coastal contour transects, inland transects oriented perpendicular to the coast, and total counts on a sample of small islands and ice floes. We focused effort in the high-density coastal stratum and designed protocols to enable simultaneous collection of double-observer and distance sampling data from the helicopter platform. We flew >300 hours and 40,000 km during each year's survey period, and 816 and 1,003 individuals (616 and 790 independent bears) were observed in 2009 and 2010, respectively. Detection function shape differed between years, likely attributable to observer experience and variable sighting conditions. Standardized encounter rates were greatest in near-coastal strata (48.6 bears/1,000 km for coastal transects in 2009), although bears were observed >40 km inland. We present abundance estimates, assess relative precision of multiple analytical techniques, and evaluate inter-annual consistency. We review the benefits and limitations of aerial surveys in polar bear management and monitoring during a time of rapid climatic change and discuss their application to other subpopulations.

SESSION 10:  
POPULATION ECOLOGY OF BEARS

# Population regulation of grizzly bears on an industrialized landscape: the case of the changing bottom

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The hypothesis that landscape industrialization would strongly limit grizzly bear populations was tested in southeastern BC, Canada, 1978 to 2007. Predictions included a declining population during developments and a lower density of bears than in an undeveloped control. Both hypotheses were rejected. In the decade with most industrial activity (1978 to 1987) and the decade following (1988 to 1998), the population increased ( $\lambda$  of 1.07). Reproductive rates were 0.37 in the first decade but dropped to 0.24 in the second decade and further to 0.19 during third decade (1998 to 2007). Cub survival declined to 0.23 in the third decade from 0.75 in the 2 previous decades. In the third decade, females transitioned from alone to alone 41% of the time, while only 9 and 21% of the transitions were alone to alone in decades 1 and 2 respectively. Most bears (84%) that died when carrying a functioning radiocollar (n=32) were killed by people; and 77% of these were shot from either a road, camp, or residence. DNA hair traps distributed in 7 x 7 km grids in the industrialized landscape (BC) and the adjacent protected area (Glacier National Park, US) detected a similar number of male bears per site (BC = 0.22, US = 0.19) but more females were detected in BC (BC = 0.34, US = 0.16). Sites in the pine forest bench lands with most logging recorded 0.67 detections of females but only 0.16 in the similar area in the control; male detections did not differ in these habitats. Long-term fire history related to warming climates since the end of the “little ice age” and resulting influence on huckleberry production, the dominant fruit and energy source of these bears, appears to be regulating this population and overshadowed effects from the numerous human activities.

# Silver spoons, forest landscapes, and grizzly bear body size patterns in Alberta

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Grizzly bear (*Ursus arctos* L.) body size varies widely in both space and time. Understanding these patterns is critical to understanding population processes in bears, including the effects of environmental change on bears, such as climate warming and habitat fragmentation. Here we evaluate six hypotheses explaining spatial and temporal variations in springtime body mass, length, and body condition for 107 unique bears captured over a ten-year period (1999-2008) and over a 750-km span of western Alberta, Canada. Our hypotheses included: (1) population density (inter-specific competition); (2) regional habitat productivity (climate normals and ecosystems); (3) inter-annual variability in productivity, including ‘silver spoon effects’ that relate to natal environmental conditions; (4) local habitat quality; (5) human disturbances; and (6) landscape change. Local habitat quality, human disturbances, and landscape change were measured from use data from GPS telemetry observations, while regional and inter-annual productivity were estimated for each bear’s home range centroid by reconstructing climate conditions with historical weather data and a climate-elevation model. Hierarchical linear regression was used to evaluate the overall contribution of each hypothesis to each body size measure given sex-age and offspring dependency differences. We found that regional productivity and ‘silver spoon effects’ (i.e. natal environments) were important determinants of body mass, length, and body condition regardless of bear age. Local measures of habitat quality further explained spatial patterns in body mass, length, and body condition with canopy variability negatively related to body mass, annual rates of landscape change positively related to body length, and use of patchy regenerating forests positively related to body condition. These results suggest that for body size patterns in grizzly bears the environmental conditions one is born into is as important, if not more so, than recent environmental conditions, and that the most important local habitat factors relate to measures of forest heterogeneity.



# Effects of conspecifics on habitat selection by grizzly bears in the southwest Yukon, Canada

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Sexual segregation, conventionally defined as the differential use of space (and often habitat and forage) by the sexes outside of the mating season, is a phenomenon that occurs across many mammalian species. Despite its prevalence, sexual segregation in carnivore species such as grizzly bears (*Ursus arctos* L.) has received little attention. Numerous hypotheses have been proposed to explain sexual segregation in mammals; however, only two are relevant for solitary, sexually dimorphic species like grizzly bears. For bears, sexual segregation may be driven by: 1) physiological differences in nutritional requirements, and/or 2) size and reproductive status-related needs to avoid predation or conspecific aggression. We investigated sexual segregation for grizzly bears in the Kluane Region by developing a set of seasonal (hypophagia and hyperphagia) explanatory models for bear habitat use that incorporated conspecific distribution as an independent variable. To build these models we used relocation data from 68 individuals (30 males, 38 females) captured and fitted with radio collars. We used logistic regression to estimate third-order habitat selection. By incorporating conspecific distribution as an explanatory variable it was apparent that, although competition or infanticide risk did not always appear to drive segregation, all lower status cohorts showed some avoidance of higher status individuals. Our data produced mixed results but generally indicate that conspecific avoidance was the primary factor affecting segregation of family groups from other cohorts in both feeding seasons.

# Litter size reduction reveals sibling competition in brown bear *Ursus arctos*

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Life-history theory predicts a trade-off between offspring size and number. Manipulation experiments on birds and small mammals found positive effects of clutch or litter size reductions on offspring mass. Although we might expect similar responses, there is no information on the strength of this trade-off in large carnivores. Based on long-term monitoring of brown bears (*Ursus arctos*) in Scandinavia, we examined how natural variability in litter size and partial litter loss affects yearling mass. The majority of cub loss (85%) occurred during the mating season (middle of May – middle of July). We monitored 395 cubs born in 140 litters to 53 mothers over 25 years. Mothers and their surviving offspring were captured in the following year, and we weighed 308 yearlings. Litter size at den emergence ranged from 1 to 4 (average 2.7). Litter size and yearling mass were negatively correlated, mostly because singletons were about 30% heavier than individuals born in litters > 1. Body mass of individuals from litters ≥2 was on average lower when the entire litter survived in comparison to reduced litters. When litter size was reduced, the survivors were on average 8% heavier as yearlings than individuals in litters that had not been reduced. These results suggest a mother-offspring conflict over optimal litter size. Intra-litter competition seems to reduce the growth of individual cubs.

# Are bears effective seed disperser in the temperate forest ecosystem?

## Estimate of the seed shadow created by the Asiatic black bear

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We estimated the seed shadow created by the Asiatic black bear (*Ursus thibetanus*) in order to evaluate the bears' effectiveness as a seed disperser. We combined data from bear movements, determined by GPS telemetry, with data from gut retention time (GRT). We estimated plant seed shadows in two ways: from direct movement data to give the actual seed shadow (ASS), and from cumulative movement data to give the potential seed shadow (PSS). The purpose of this study was to answer the following questions: (1) Does seed shadow vary among sex, seasons, estimation method (ASS or PSS), and years? (2) Does the masting affect seed shadows? Combining these data, the seed shadows produced by long GRT and large daily movements suggest that the bears effectively move 40% of the seeds they consume to a distance greater than 500 m from the parent tree and can potentially move the seeds up to a maximum distance of more than 22,000 m from the parent tree. The results also indicate that bears make complex seed shadows caused by multiple defecations and long periods of daily movement. In summary, PSS did not differ between sexes, but PSS can be expected to be larger in autumn than in summer of each year. ASS, however, can be expected to be larger in males than females, and to be larger in autumn than in summer. ASS may become especially large during a poor masting year as compared to good masting years. These results indicate that bears are potentially more effective seed dispersers during years of poor hard mast production in autumn. The bears have one of the longest seed retention times among endozoochorous dispersal agents inhabiting the temperate zone, and it has longest seed shadows than other seed disperser.

SESSION 11:

INVITED PANEL ON BEAR FEEDING

# Bear feeding: an overview of current policies and state of knowledge

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Artificially providing food for bears is a complex and controversial topic with both biological and ethical aspects, as well as implications for conservation, management and human-bear conflicts. Bears have a long history of using anthropogenic food sources inadvertently or deliberately provided by people. Bear management approaches to feeding bears have been evolving as understanding and perceptions of bear biology and human-bear conflicts change, and management options are explored. The question of the appropriateness of feeding from a bear management perspective depends on the goal (e.g., to attract bears for viewing, to divert bears from other food sources, or to provide bears with more nutrition) and a host of other factors, such as the where it's done, how it's done, who does it, what kind and how much food is involved, timing and duration, actual or potential effects, etc. I propose a standard terminology to clarify and facilitate the discussion. Careful use of mutually understood terms is essential. I also propose a framework for considering the topic based on reasons for feeding, conditions of feeding, and the potential effects of feeding bears using some recent examples of different types of bear feeding, and observed effects. I review some of the historic information and literature on bears' use of anthropogenic food to address the question of how we got to where we are in terms of our current thinking about the consequences of feeding. I will also summarize data from a survey of North American bear managers on regulations, policies and other issues related to bear feeding from jurisdictions across the U.S. and Canada.

# A fed bear is a dead bear: how this catchy phrase and management philosophy led to positive changes for bears and visitors in national parks

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Preventing bears from obtaining anthropogenic foods and garbage is the underlying foundation of bear management programs in U.S. national parks. This philosophy evolved over more than a century of trying to balance recreational activities with resource protection. During the early history of most national parks, human food and garbage were a common component of bears' diets. Bears obtained anthropogenic foods from garbage dumps and feeding stations, hand feeding by visitors, and unsecured foods and garbage in developments. Although interacting closely with bears delighted most park visitors, large numbers of people interacting with human food-conditioned bears also led to high numbers of bear-human conflicts. During the 1930's-60's, there were an average of 48 bear inflicted human injuries and 138 incidents of bear-caused property damage per year inside Yellowstone National Park (YNP). Most of these conflicts were directly related to the hand feeding of bears by the public or from bears searching for unsecured human foods and garbage in developments. The proximity of garbage dumps and bear feeding stations to public use areas was also considered a contributing factor. The high number of bear-human conflicts also resulted in many bears being removed from YNP annually. After closing the garbage dumps and feeding stations, prohibiting hand feeding, bear-proofing all food and garbage containers, and educating park visitors about the negative consequences of allowing bears to obtain human foods, bear-human conflicts decreased significantly to just 1 human injury and 12 property damages per year. Even without viewing stations and public feeding, thousands of visitors still see bears annually, building a constituency of public that support bear conservation. The national park service experience demonstrates that bear populations can be maintained in a manner that provides for the safety of bears, park visitors and visitors' property, while still providing the public with opportunities to view bears.

# Can food lead black bears out of trouble?

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Everyone knows that food can lead black bears (*Ursus americanus*) into trouble, but can it lead them out of trouble? Mounting evidence shows that food can be a powerful tool in reducing bear/human conflict, depending upon quantity, quality, and placement of the food. Where necessary, diversionary food can be placed away from human habitation to minimize bear-human contact. However, residents commonly hand-fed bears in the rural community we studied for 8 years (1984-1991) and in the one we studied for 15 years (1996-2010). In the latter community, bears had been hand-fed since 1961 and were sufficiently habituated and food-conditioned that we radio-collared them without using tranquilizers. The low incidence of nuisance problems in these communities in northeastern Minnesota indicate that the driving force behind nuisance behavior is hunger—not habituation and food-conditioning, which tended to be specific to locations and situations. In these communities, we found that:

1. No one was attacked, house break-ins were rare, and nuisance complaints were fewer and less serious than elsewhere in the region.
2. As residents replaced misconceptions with close-up experience with bears, they became willing to coexist.
3. Where residents preferred not to see bears, reducing attractants was especially effective in reducing conflict because bears easily diverted to supplemental feeding sites.
4. Bears preferred wild food or diversionary food over going house to house for small rewards.
5. No bear became dependent upon supplemental food.
6. When natural food was abundant, bears went weeks, months, or years between visits to supplemental feeding sites.
7. Bears continued wild behaviors (foraging, mating, scent-marking, exploring new areas, investigating den sites, defending territories, dispersing, etc.)
8. Despite being hunted, the habituated, food-conditioned bears in these studies survived up to 26¾ years and included some of the oldest bears in the population.

# Experimental diversionary feeding of black bears at Lake Tahoe, CA

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Due to severe drought conditions made worse by forest fires in the summer of 2007, the native black bear population around Lake Tahoe (California and Nevada, USA) suffered an extreme shortage of its native food supply. These dire circumstances led to record numbers of bears entering unattended homes and cabins that were well stocked with food. The BEAR League, a locally well-known and pro-active wildlife advocacy NGO sought approval to launch a controlled and carefully orchestrated diversionary/supplementary feeding program in order to assist the bears and reduce the damage to people's homes. The request was denied, because such feeding is illegal in California, but the BEAR League chose to secretly go forward with the plan anyway. Natural food was donated by orchards and delivered to an indoor location where teams of volunteers came daily to fill backpacks and hike it into specific areas on the mountainside. After a few days, all traces of food disappeared nightly and abundant bear scat was found. Records were kept on the amount and location of food provisioned, dates of provisioning, and number of house break-ins before versus after the feeding was initiated, as well as in a nearby areas where feeding could not be conducted. The number of house break-ins dramatically declined shortly after the feeding commenced and remained so until the bears dened, whereas the control zones, where feeding was not possible, continued to suffer high numbers of break-ins during the entire period. The bears that benefitted from the program did not resort to raiding cabins the following year when natural forage supply returned to normal. While the data gathered here point to positive effects, future efforts would benefit from cooperation of the state agency, both in terms of program implementation as well as scientific integrity.



# Food for thought: why diversionary feeding may not be an effective management tool for urban human-bear conflicts

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Human-bear conflicts are increasing worldwide for many ursids. In the American West, human-black bear (*Ursus americanus*) conflicts in the urban environment are becoming more frequent, demanding greater resources to alleviate the conflict. Current management tools targeted at bears include removal, translocation, and aversive conditioning, actions that can have limited success and often lack social tolerance with urban residents. As a result diversionary feeding is often suggested as an alternative solution to conflicts, especially in years of poor natural food production when conflicts are high. In this talk I will draw upon a 5-year study on bear behavior in the urban environment of Aspen, Colorado, USA, to discuss why diversionary feeding may not be an effective management tool for urban human-bear conflicts. Using insights gained from spatial location (GPS) data collected at 30-minute intervals, activity patterns data collected at 5-minute intervals, and backtracking data collected to quantify feeding behavior of bears in the urban environment, I will ask whether or not: 1) diversionary feeding targets the “right” bears; 2) feeding is effective despite the continued availability of conflict attractants; and 3) feeding has the potential to harm bears long-term by making them dependent on human food sources. Finally, I will discuss possible impacts to bear demographics, especially when feeding is implemented in bad natural food production years.

# Effects of supplemental feeding on bear spatial behavior, habituation on people, and human-bear conflicts: studies of long-term intensive feeding of brown bears in Slovenia, Europe

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Brown bears were exterminated from most of Europe with exception of few remaining population that now have to live in human-dominated landscape. Coexisting with people often lead to considerable conflicts, which today present a major threat for long-term conservation of the species. Supplemental feeding of bears is a controversial measure that is used for various purposes, including reduction of human-bear conflicts. Although it is expensive and is in some regions intensively practiced, effects of supplemental feeding are surprisingly poorly studied. Slovenia encompass northern part of high-density Dinaric subpopulation of brown bears and represent a good study case to explore effects of supplemental feeding, since feeding of wildlife, including bears, is very intensive and has been practiced in some parts for over a century. Previously bears were fed mainly with maize and carrion, but the latter is forbidden since 2004. According to common belief this is one of the main reasons for increase of human-bear conflicts in the last years. Currently we are running several projects studying effects of supplemental feeding that are based on analysis of scat and stomach content, monitoring of bear use of the feeding sites, analysis of human-bear conflicts, and analysis of GPS telemetry data. Our presentation will focus on effects of supplemental feeding on spatial behavior of bears, including probability to approach human settlements and cause conflicts, effects on bear time activity budget, and importance of supplemental food for the bear nutrition. Preliminary results indicate that supplemental feeding strongly effects annual, seasonal and circadian spatial distribution of bears, while effects on human-bear conflicts are negligible or even counterproductive. In contrast to common belief carrion at the feeding places does not appear to be an important component in bear diet and is not particularly selected compared to other supplemental foods.



## SESSION 12:

# HUMAN-BEAR CONFLICT / HUMAN DIMENSIONS

# Human-bear conflict: a review of concepts and global trends

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Human Bear Conflict (HBC) is an international problem involving all eight bear species. HBC can cause severe economic losses, injuries, human fatalities and have serious consequences for bear welfare and conservation. Despite these negative impacts, to date, efforts to synthesize global knowledge about these conflicts have been extremely limited. For management and conservation strategies to be effective, a thorough understanding of HBC is necessary. With this aim, we surveyed bear biologists working on HBC issues from around the world and obtained responses from >100 representing 33 countries and all 8 bear species. Survey respondents provided their opinions pertaining to: (1) the existing level of HBC baseline information; (2) the dynamics of HBC (types, causes, severity, trends); (3) the attitudes and relevance of HBC to the various stakeholders; (4) the effectiveness of techniques that wildlife agencies use in response to HBC; and (5) constraints that hinder efforts to address HBC. We also used this survey as an opportunity to create a profile of key actors working on the HBC issue. Survey respondents also provided an insight into their own perceptions of: (1) how they define HBC; (2) their role in addressing HBC; (3) the impacts of HBC; (4) the aims of HBC management strategies; and (5) the global trends of HBC. Despite the unique circumstances of national politics, laws, cultures, economics, environmental attributes, and types and numbers of bears, all countries need to strive to develop systems to document and evaluate the effectiveness of their actions to prevent and manage conflict. We believe that the information generated by our study will help to facilitate the development of such systems by providing a much needed global overview of the HBC issue and an insightful comparison of the varying responses by governmental bodies and NGOs.

# Factors driving range requirements and habitat use of a population living on the edge: *Ursus americanus* thriving in a fragmented, agricultural landscape

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The American black bear is a forest-dwelling species, but also an ecological opportunist. Few studies have investigated ecological requirements for American black bears in highly-fragmented habitats. Northwestern Minnesota is particularly well suited for such a study because it marks the historical western edge of black bears in the eastern U.S. This area is a patchwork of forest (<20% coverage) and agricultural lands, with contiguous forests eastward and agriculture (formerly prairie) westward. Our study aimed to discern factors affecting the range requirements and habitat use for bears living in human-altered landscapes. We hypothesized that these bears would (1) have larger home ranges (2) be more reliant on anthropogenic food sources, and (3) have more conflicts with humans than bears living in contiguously-forested areas. During 2007-2010, we collected 45 bear-years of location data with GPS collars. Male (but not female) home ranges were larger than previously reported for this species, and males used agriculture fields (mainly corn and sunflowers) much more than females (fall locations: males = 24%, females = 1%). We employed a novel analytical approach to assess habitat requirements: we examined area of use and landscape metrics within home ranges defined by a narrow (e.g., 3-week) sliding window of time to determine shifting habitat needs, using measured food availability as a covariate. We examined movements of the centroid of these short-interval ranges to identify drivers of ultimate home range size (e.g., distance between forest patches). Males and females used similar-sized areas within 3-week windows, but centroid movements for males were significantly larger. We propose reasons for this disparity in the differing strategies employed by each sex for living in a highly-fragmented landscape. These insights may be useful for understanding how bears exist in marginal habitats around the world, and guide strategies for managing landscapes to mitigate human-bear conflicts.

# Human-bear conflicts influence villagers' attitudes but not necessarily behaviors

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Human-wildlife conflicts often cause retaliatory killing, which may be a major threat to some wildlife species. Asiatic black bears depredate crops and livestock and also attack humans. We surveyed local people to assess their attitudes and behaviors toward black bears in Sichuan Province, China. We conducted 1181 semi-structured interviews within 429 15x15-km cells across the province, asking villagers about bear occurrence, population trends, attitudes toward bears, human-bear conflicts, responses to bear damage, and bear poaching. Bears raided crops (n=174 cells), killed livestock (n=114 cells), and attacked people (n=49 cells). Reports of bear damage did not vary by ethnicity, however, more Han respondents (28.3%) than Yi (10.6%) or Tibetans (8.7%) reported willingness to retaliate bears if they suffered the loss from bears. Fifty percent and 43% of villagers held negative and neutral attitudes toward bears, respectively; attitudes were more negative among people who had previous interactions with bears or lived where bear encounters were more likely. Although killing bears was illegal, villagers in 117 cells indicated that bear poaching occurred around their villages. However, killing bears was not significantly linked to damage: indeed, killing was more common in areas without human-bear conflicts. Poachers killed bears mainly for trade of their valuable parts (gall bladder and paws, 78.5%). Tibetan people experienced bear damage and also had negative attitudes toward bears, but reported less poaching than Han or Yi people, due to their religious beliefs. We conclude that real or perceived threats of bears destroying property or causing bodily harm shaped people's negative attitudes toward this species; however, actions against bears were mainly motivated by the economic value of bear parts rather than people's negative attitudes. Efforts to alleviate bear damage to crops and livestock might benefit bears indirectly through improving local support for bear conservation, however, controlling poaching and reducing market demand for bear parts will be the most productive conservation measure.

# Trekkers' preferences for bear-encounter risk management in Daisetsuzan National Park, northern Japan: using a choice experiment

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The purpose of this study is to examine trekkers' attitudes toward brown bear (*Ursus arctos yesoensis*) appearances and preferences for risk management on the trail, in Daisetsuzan National Park, northern Japan, using a choice experiment. Choice experiment is one of the methods in empirical stated preference analyses and has been applied widely in environmental valuations. Human-brown bear interactions occur in the park occasionally. Wildlife managers need to manage a balance between bear-encounter risks and the benefits of recreation activity in the park. Our choice experiment survey was used to assess trekkers' preferences for alternative hypothetical scenarios with combinations of destinations of the trail, bear appearances, the number of other trekkers, and patrol systems of the trail. The Numameguri Trail in the park, which is our study area, is the most frequent area for the encounters because this area is high density for both brown bear habitat and recreation usage. An on-site return-mail survey was conducted at the area in September 2009. A total of 1,536 questionnaires was distributed, and 970 were returned. Conditional logit results showed that the negative coefficients on bear appearances and the positive coefficients of more secure patrol systems of the trail were statistically significant except for introducing park rangers carrying rifles with metal bullets. A positive sign means that the levels influence respondents' utility positively, and those with a negative sign mean that the attribute levels influence respondents' utility negatively. In addition, the positive sign of the trekkers' numbers coefficient was statistically significant. Thus, trekkers want secure trekking in the trail without negative impacts on the bear population. Furthermore, mixed logit results show that the parameters of bear appearances were random parameters—that is, the trekkers have a wide range of preferences for bear appearances. The managers should take these various risk perceptions into consideration.



# Investigation on black bear-human conflict in Kashmir, India

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The study presents black bear-human conflict between 2001 and 2009 in Kashmir, India. 282 conflict cases were reported resulting in the death of 19 persons. The distribution of conflict across Kashmir showed that South Division of Kashmir recorded the highest cases (n=166, 58.86 %), followed by Central (n=60, 21.27 %) and North (n=56, 19.8 %). Black bear *Ursus thibetanus* attacked more human males (n=223, 81.98 %) as compared to females (n=59, 20.92 %). Black bear attack caused serious injury in 212 persons (75.18 %) affecting normal livelihood while 70 persons (24.82 %) had minor injuries. 230 attacks (81.5 %) occurred in the agro-ecosystem while 52 attacks (18.4 %) occurred in the forest ecosystem.

Increase in conflict motivated the WSOS team to conduct abundance estimation of black bears in Kashmir. The study was conducted during 2008 and 2009. Transects were randomly laid in the three divisions, namely Central, South and North Divisions of Kashmir and monitored. The study found that South Division has highest encounter rate ( $1.78 \pm 0.4$  evidences/km), followed by North ( $1.23 \pm 0.4$  evidences/km) and Central ( $0.78 \pm 0.3$  evidences/km).

The presence of black bears caused panic among locals. People usually chased bears resulting in multiple attacks on humans. A case was reported where a male black bear attacked 25 persons before being killed by the locals. Creating awareness and promoting local participation is vital in any management plan designed for conserving the black bear. The team has organized 26 community programs in the villages and 50 education programs in schools and colleges. 10 tranquilization workshops were conducted imparting training to the wildlife staffs. An extensive education awareness drive is planned to be launched across Kashmir. Joint-venture programs have been initiated which are aimed at strengthening the relations between locals and managers and developing public support in black bear-human conflict mitigation.

# Socio-economic survey of rehabilitated Kalandars in India, (pre and post rehabilitation)

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Wildlife Trust of India (WTI) with the support of World Society for Protection of Animals (WSPA), UK is presently implementing a project on conservation of sloth bears of India since 2005 along with *Kalandars* a traditional community that made its living through the practice of bear dancing. Sloth bear is enlisted in schedule I of Wildlife Protection Act, 1972, hence bear dancing or possessing a bear is illegal and a punishable offence. The project attempts providing alternative livelihood to the community of Kalandars in the states of Madhya Pradesh, Chattisgarh and Bihar in India, who had surrendered their bears and had agreed to adopt an alternative livelihood under the WTI-WSPA joint initiative. The paper provides a detailed account of the programme activities including a monitoring framework through a set of 7 indicators. The pre and post implementation surveys have revealed that while Kalandars under the programme have not reverted back to the traditional practice, the practice of bear dancing is continued to be practiced at remote parts of India. Cross border movement of the community with the bears have also been reported. The communities still feel that the alternate livelihood provided to them have not been adequate enough to meet their requirements. With continued help and support of the communities and the government authorities, the programme envisages that this traditional practice of dancing bears will be completely eliminated from India.

# Identification of human-bear conflict zones for Andean bears in Bolivia

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We identified potential human-wildlife conflict zones, i.e. potential habitats with a high risk of being colonized and transformed into a human dominated landscape, for the largest carnivore of the Tropical Andes, the Andean bear (*Tremarctos ornatus*) in Bolivia.

As baseline information for this study we used maps depicting the suitability of the study area for both bears and humans. The bear maps were used to delineate potential conflict zones at three levels: (1) the overall suitability of the region for bears (2) the key patch level, which delineates areas where bears can maintain viable populations and (3) the connectivity map delineating areas suitable that are important for bear dispersal. The human map on the other hand, was created to identify probabilities of human occurrence along the study area based on main economical activities of the region.

Our analysis showed that human-bear conflict is likely to occur at all three levels. The areas where these conflicts were more likely to occur were at some areas of the North section but at much large extent along the South section. Although habitat patches in the South were considered too small to sustain a viable population, this section can be considered the most critical in terms of bear conservation.

Overall, this analysis identified different prioritization scenarios in order to determine where conservation actions may be taken in order to minimize negative effects of human activities on bear populations or habitats and maximize conservation efforts. Andean bear conservation efforts have certainly increased during the past years. However success of conservation actions will largely depend on human attitudes and views towards bears and wildlife in general.

# Hunting brown bears as a key management tool in Croatia

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Croatia is in the final part of the accession process to the European Union (EU). Legislation on conservation of natural resources is an important part of the negotiation process. Surprisingly, most of the current EU member states accepted the “strictly protected” status for the brown bear, including the ones sharing the largest European brown bear populations like Carpathian (Romania), Scandinavian (Sweden), and part of Dinaric-Pindos (Slovenia). Only Finland and Estonia did put exception for bear from Annex II of the Habitats Directive. The Brown Bear Management Plan for the Republic of Croatia defines bears as game and Croatia asked for exception of bear from Habitat Directive and expects to become the first EU member with bears as a regular game species. The strong arguments to support this approach are: 1) the Croatian bear population grew with continuous hunting from less than 100 to 1000 in the past 60 years, 2) bears are well accepted by local inhabitants, 3) bear hunting provides economic profit to hunters, 4) damages caused by bears are not significant, 5) management of problem bears is straightforward (with less than 2 bears removed in an average year). In the last couple years the national yearly hunting quota was set at 100 plus up to 40 bears expected to be lost due to other reasons (traffic, problem bear removals etc.). Preliminary results of population dynamics modeling also prove hunting as an effective and favorable tool for the long term conservation. The problem is that full realization of quota has become hard to achieve, mostly due to limited market. That means that the hunting management has to be adapted continually.

# Interaction between grizzly bears and backcountry users in Yellowstone National Park, bear management areas

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In 1982 Yellowstone National Park implemented a Bear Management Area (BMA) program. This program was created to restrict human recreation in pre-determined areas of Yellowstone with high seasonal concentrations of grizzly bears (*Ursus arctos*) and grizzly bear foods. The goals behind the BMA restrictions were to: minimize bear-human interactions that may lead to habituation of bears to people, prevent human-caused displacement of bears from prime food sources, and decrease the risk of bear-caused human injury in areas with high levels of bear activity. The objective of this study was to measure fine scale recreation patterns and grizzly bear behavioral patterns to determine if the original regulations for BMAs were still providing adequate foraging opportunities and reducing human-bear interaction.

This study was conducted from 2007 to 2009. During this time 387 backcountry recreational users were randomly selected and asked to carry Global Positioning System (GPS) units on their overnight backcountry trips or day hikes. Each GPS unit was programmed to collect near continuous location data programmed for use throughout the duration of an individual trip. Concurrently, 21 grizzly bears were sampled and fitted with Telonic's Spread Spectrum GPS radio collars. Each collar was set to record a fix from between 30 to 60 minutes, maximizing the number of relocations per animal.

The data was analyzed in a Geographic Information System platform and the results determine when, where and if interactions between humans and bears occur. Furthermore, the study provides detailed information about how grizzly bears use the landscape in relation to varying levels of recreational use, including areas of Yellowstone that are closed, restricted or open to recreation. The data from this study has been compared to current BMA guidelines to help determine if the current rules are adequate for bear management or if different regulations should be implemented.

# Poaching of sloth bear cubs and illegal trade routes in India

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Sloth Bear Conservation and protection is becoming increasingly challenging in India as bear habitat is disappearing rapidly assisted with fierce economic development. An exploding human population competes with Sloth Bears for scarce forest resources and space.

Female Sloth Bears select dens with great care but still fall prey to extremely skilled trackers and poachers who use various hunting methods to poach bear cubs and sometimes even mother bears! Sloth Bears are an ecologically critical species and poaching of bear cubs takes a heavy toll not only on species population but also on delicate ecological balance that is disrupted easily. The poachers trade sloth bear cubs using a complex network of illegal trade routes across India, often changing several hands before the cubs reach a Kalandar tribe settlement where they are trained to become performing bears or transported into the neighboring country of Nepal where they disappear!

Wildlife SOS monitors the illegal trade routes in various states in India through its vigilant Forestwatch! anti poaching program using a network of informers, decoys and undercover operatives who work closely with Government enforcement agencies to bust poachers and seize bear cubs while enforcing the wildlife protection laws. Wildlife SOS has also achieved remarkable historic success in bear conservation by ending the Bear Dancing practice in India, converting poachers to protectors and creating livelihood for kalandar tribals that depended on bears for livelihoods as well as working with women and children in the community to ensure long term sustainability in bear conservation. Wildlife SOS also established four bear rehab centers and a Bear Hotline to monitor and track any performing bears that may recur in India. Currently Wildlife SOS is in the process of an investigative research survey project to document the trade routes of live sloth bears and bear parts in Nepal!



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115	Preliminary estimates of black bear density in caribou calving areas, Newfoundland, Canada	Lewis, Keith, M. Mumma, L. Waits, C. Zieminski, C.E. Soulliere
116	Estimating the Ontario black bear population at management unit and landscape scales	Obbard, Martyn E., E.J. Howe, and C.J. Kyle
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121	In den mother-cub behavior and communication in the grizzly bear ( <i>Ursus arctos horribilis</i> )	Owen, Megan A.1, P.D. Crowe1, A.L. Dewing1, C.T. Robbins2 and R.R. Swaisgood1
122	Orphan bear rehabilitation centre a pilot project in the Romanian Carpathians	Leonardo Bereczky, X. Anegroaei
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125	Age affects embryonic diapause in female giant pandas ( <i>Ailuropoda melanoleuca</i> )	Crowe, Pamela D., M.A. Owen, Z. Zhang, X. Zhou and R.R. Swaisgood
126	Zoos and their role in conservation of bear species in India	Akhtar, Naim and B.K. Gupta
127	Chronic kidney failure in captive Asiatic black bear	M. Bednarski, D. Huber, R. Maslak, T. Piasecki, A. Sergiel and Z. Soltysiak
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129	Chronobiological shifts in captive newborn giant panda cubs ( <i>Ailuropoda melanoleuca</i> )	Pertl, Martina, R. Pfistermüller, H. Kratochvil and A. Krop-Benesch

# THEME: ATK AND BEARS

## 1. The Andean bear (*Tremarctos ornatus*) in the Bolivian culture

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The Jukumari or Andean bear (*Tremarctos ornatus*) is the only representative of the family Ursidae in South America. The tradition, myths and legends that involve this species in the Bolivia are scarce and disperse, despite of the importance of this species in the culture. This study presents a bibliographical revision and interviews to indigenous communities collecting information related to this animal is recognized with diverse common local names, Jukumari or jukumari, Jüyütñeñej; which imply a mystical sense, a creature intermediate between a human being and a beast, born of the union of a woman and a bear. In Bolivia during the colonial and republican period, the jukumari acquired a great symbolic importance in the oral literature, festivities and folkloric dances. The bear is a personage in folklore manifestations related to the syncretism of catholic religion. In some dances of Bolivia the bear plays a central figure, as a buffoon's role as in the "Diablada" or the "Morenada", were the jukumari as main personage of the wildlife. Also is highlighted the powerful image of the bear as a fight beast; when fighting, they stand in a raised position and use the arms to slap and the claws of an almost human way. This style of hand-to-hand fighting is inspired in the dance of the "Thinku" that is initially performed by Qaqachaka and Jukumani indigenous communities of Potosí and Oruro. Some traditional stories refer to the jukumari as the "Son of the bear" which tells the suffering and confinement of a woman kidnapped by a bear; Highlighting the jukumari as a mixture of human and beast, granting its strength and intelligence. Finally I discuss that the beliefs and knowledge that surrounds the jukumari, can be a tool for the conservation of this species in rural and urban areas.

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## 2. Action research and the human dimensions of polar bear management in Ontario

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### Objectives

Bear human interactions are projected to increase throughout Northern Canada but especially throughout the sub-arctic and arctic. For the Cree communities of Northern Ontario these increasing interactions with polar bears and black bears are of concern. For the past three years, the Washaho Cree Nation at Fort Severn has been developing pro-active bear management strategies (monitoring human-bear encounters, examining financial compensation for property damage) in-order to address these changes. We present here the results of a collaborative research project between the First Nations of Washaho and Weenusk, the Keewaytinook Okimakanak Research Institute (KORI), and the Centre for Northern Studies at Lakehead University. The goal of the project was to acquire a greater understanding of Cree knowledge regarding *wabusk* (polar bear), document human-polar bear interactions in the territories of the Weenusk and Washaho Cree nations of Ontario, and emphasize

the political aspects of knowledge production. This presentation will pertain to the methodological portion of the study, recommendations and findings will be discussed in other project-related presentations on ATK.

### Methods

The projects were guided by the four pillars of action research: capacity-building, respect, equity and empowerment or CREE. Capacity-building was defined as a process requiring an understanding of the impacts of different historical perspectives and socio-cultural beliefs on wildlife management. Respect pertained to listening to First Nation citizens. Equity was initiated by hiring local field assistants and translators. Empowerment occurred through the endorsement and involvement of all reports, publications and presentations by both First Nations.

### Results

Highlighted here is a discussion regarding the implementation of an action research project on polar bear management in Northern Ontario. Challenges and opportunities are also discussed.

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## 3. Applying traditional knowledge to grizzly bear management on the Yukon North Slope

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Wildlife managers that work in co-management environments have seen the potential for traditional knowledge to empower communities and take ownership over wildlife management, to inform management by corroborating empirical data, to offer alternate perspectives or fill information gaps, and to facilitate the scientific process through inductive and deductive reasoning. As part of a larger grizzly bear (*Ursus arctos* L.) study on the Yukon North Slope, we interviewed locals to gather their traditional knowledge about the grizzly bear population. We summarized the traditional knowledge provided by these local users and incorporated this knowledge into a framework for grizzly bear management on the Yukon North Slope. The information provided by local hunters and stewards contributed to understanding regional grizzly bear population and habitat trends, habitat use, cultural values and local bear management strategies. We did not find any inconsistencies between empirical scientific data and traditional knowledge.

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## 4. Wildlife habitat modeling using traditional ecological knowledge

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Inuit, like hunters worldwide, call upon resource managers to use their traditional ecological knowledge (TEK). In Nunavut, Canada, the co-management system requires the use of *Inuit Qaujimanituqangit*, Inuit traditional knowledge, in research and decision making. Incorporating TEK in wildlife conservation as quantitative information has been limited to thematic map products (e.g.,

species distribution) or contextual information. To make progress in integrating TEK with science for management is important to test approaches for developing ecological models from this information.

We studied the polar bear (*Ursus maritimus*) movements, sea ice habitat selection and climate change in Foxe Basin, Nunavut. Standard data collection methods (satellite GPS telemetry and satellite imagery) were used for this research but we are challenged with limited possibilities for *in-situ* data validation. We are exploring approaches for incorporating TEK in scientific research to improve understanding of fine scale polar bear sea ice habitat use.

Inuit elders and polar bear hunters from six communities were interviewed to collect information about seasonal polar bear sea ice habitat use and distribution. A total of 33 individual and 5 focus group (15 participants in total) interviews were completed following a standard set of questions using the semi-directed interview method. The recorded interviews were conducted in Inuktitut, using an interpreter to sequentially translate the discussions. Spatial information was collected directly onto regional maps. We coded and digitized the interviews and map information. We used the expert knowledge (or opinion or belief) framework within which to transform TEK into a quantitative format. We will present TEK habitat models and discuss how the TEK habitat models compare with and complement the scientific data habitat models at the same spatial scale.

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## THEME: BEHAVIOUR OF BEARS

### 5. Daily and seasonal activity patterns of Andean bears photographed by camera traps in montane forests of southeast Peru

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Since 15 November 2009 we have used unbaited camera traps to collect information on the presence and activity of Andean bears in southeast Peru, on the east side of the Andes in the districts of Camanti and Marcapata. Camera traps were deployed at two cloud forest sites and one transitional montane forest site. Local topography prohibits the establishment of a sampling grid or stratified sampling scheme, so we deployed cameras along 3 linear trails totalling 11.4km. We set one camera per sampling point, with 200m between cameras, from 850m to 3000m elevation. Two transects are near the new Interoceanic Highway ( $\leq 3.8$ km distant), but the third is more distant ( $> 24.5$ km distant).

Temperatures vary with elevation and season, with a weekly average of 21.5°C ( $\pm 0.60$ SD) at 850m elevation versus 12.2°C ( $\pm 0.33$ SD) at 2702m elevation. Rainfall varies seasonally but is abundant; below our sampling points at 600m elevation the average rainfall is 8m per year.

Some sequences of photographs of bears have not included sufficient information for individual identification. However, we have identified five adult bears and one cub, approximately two months old. We estimate that this cub was born in August or September 2009.

All cameras were programmed to function continuously. However, all photographs of bears were taken during or within 10 minutes of daylight, with the exception of an unusual photographic sequence in which a bear was seen following a giant anteater 105 minutes after sunset.



Across the transects there has been an average of 1.5 ( $\pm 1.77$ SD) independent photographic detections of bears per month. The number of detections decreased after December, and no detections occurred from March through June. This may reflect a seasonal shift in bear activity due to weather induced changes in food supply; December and January are the wettest months, followed by a rapid decline in rainfall.

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## 6. Acoustic analysis of vocalizations during giant panda breeding

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Silent for most of the year, giant pandas (*Ailuropoda melanoleuca*) engage in sustained and diverse vocal behavior during the brief annual window for reproduction. These vocalizations are suggestive of a complex communication repertoire and clearly play an important role in the facilitation of mating. Previous research has addressed the acoustic structure and significance of these vocalizations, but to date no one has examined the structure and function of calls occurring during copulation, when both sexes are highly vocal. To increase our understanding of vocal communication in this reproductive context we analyzed vocalizations of male and female pandas during breeding interactions. Digital audio recordings were collected during the breeding seasons of 2008 and 2009 at zoological facilities in San Diego, California and China (Wolong, Bi Feng Xia) and were processed using Soundtrack Pro 2.0 and Raven Pro 1.4 software. Six types of vocalizations were recorded ('bark,' 'moan,' 'growl,' 'chirp,' 'bleat,' and 'copulation call') for the purpose of this study. Comparisons of vocalizations from 29 confirmed copulations and 37 non-copulatory breeding sessions from 31 individuals (24 females, 7 males) reveal structural differences between vocalizations produced before, during, and after intromission, suggesting differing communicative roles for these vocalizations across these contexts. The sequential dynamics of vocalizations also change, with the female 'bark' punctuating the end of intromission. During intromission the male produces a 'copulation call' that acoustically distinguishes successful breeding encounters from unsuccessful pairings and until now has not been acoustically described. This 'copulation call' is more static in frequency modulation, amplitude change, and duration when compared to the male 'bleat'. These results shed light on the motivational and functional significance of panda vocalizations during mating encounters and can be utilized in captive breeding programs to promote reproduction in this endangered species.

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## 7. Analysis of mating behavior and reproductive success in the American black bear, *Ursus americanus*.

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The objective of this study was to comprehensively and quantitatively document mating in the American black bear, and preliminarily assess if mating behaviors can predict successful conception. All-occurrences recording with focal sampling and point-in-time recording with scan sampling were used to document mating behavior in five adult males and six adult females in a semi-free ranging population. Mating was categorized as successful when rear flank quivering was observed and confirmed by presence of semen around the female's vulva following dismount. By definition, unsuccessful mating attempts lacked quivering. Successful mating consisted of three successive stages: mount, intromission, and ejaculation (quivering). Seventy-three percent of successful matings were preceded by the male's anogenital investigation of the female. Males differed in the percent of attempts that resulted in successful mating, ranging from 7-36%. Most successful matings (88%) were preceded by unsuccessful mount attempts. Average duration of successful mating ( $n = 16$  mounts) was 25-fold longer ( $p < 0.001$ , randomization test) than unsuccessful mating ( $n = 127$  mounts). The intromission stage was 10-fold longer ( $p < 0.001$ ), and included 5-fold greater frequency ( $p < 0.001$ ) of thrusts/bout, in successful mating compared to unsuccessful mating. Bouts of repeated ejaculations ranged in duration from 8-34 minutes and ejaculation frequency ranged from 23-47/bout. At the end of the mating season, unimplanted (diapaused) embryos were collected from excised uteri using laparoscopy-assisted hysterectomy. Embryos were processed for DNA isolation, and paternity determined using polymerase chain reaction and polymorphic microsatellites. Once genetic paternity analyses are complete, quantitative measures of the sires' mating behaviors will be examined for correlation to genetically-determined reproductive success, as assessed *in utero*. The data presented herein expand our understanding of bear mating ecology and may provide insights into reproductive success that are applicable to captive bear breeding programs.

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## 8. Using movement rates and denning periods to estimate energy expenditure by grizzly bears in Alberta

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Previous studies of grizzly bear energetics have accounted for energy use during daily activity by assuming that the overall energy expenditure of bears is a multiple of their basal metabolic rate (BMR). However, direct measurements of movement rates using GPS collar data can be used to more accurately estimate energy expenditure of individual bears.

### Methods:

We estimated energy use by bear using body mass measures (capture weights), metabolic equations from peer-reviewed literature, hourly travel distances calculated from GPS collar data, published measurements of bear metabolism during denning, and recorded denning periods for each bear.

### Results:

Preliminary estimates of hourly and daily energy expenditures for bears in Alberta are comparable to metabolic measurements previously reported in the literature for grizzly bears and other carnivore species, but differ from some previously published estimates that applied a multiple of the BMR (i.e. derived without using movement data or metabolic measurements).

In combination with food resource models used to estimate available calories on the landscape (i.e., nutritional landscapes), an overall energy balance will be calculated and used to estimate potential carrying capacity for grizzly bears in Alberta, thus informing targets for population recovery.

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## 9. Denning behavior and winter home ranges of brown bears in Northern Greece

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Greece holds one of the southernmost populations of endangered Brown bear population in Europe reaching the 39<sup>o</sup> parallel. Its distribution is divided in two distinct nuclei covering in total 13,500Km<sup>2</sup>. Recently a species range expansion and bears are re-colonising areas of their historical distribution. Population size is estimated between 190-260 individuals (Mertzanis et al. 2009).

We monitored a sample of 24 radio-tagged individuals (16 males and 8 females, tracked for periods of 0.5-14 months). Their mean date of den entry was 7 December (range: 4 Dec - 4 Feb, n = 11) and mean date of den emergence was 8 March (range: 15 Feb - 17 May, n = 11). Mean duration of denning was 83 days (range: 0-145 days, n = 11).

Of particular note, 7 of 11 males remained active during almost the entire winter period, travelling within a winter home range averaging 36 km<sup>2</sup>(100% MCP; range 8-81 km<sup>2</sup>). One adult male showed alternate periods of inactivity and activity corresponding with winter temperatures fluctuations.

Also striking was a limited level of activity for all four pregnant females prior to parturition (average winter home range = 3 km<sup>2</sup>, range 1.5-7.5 km<sup>2</sup>); they all settled down by the end of January, and gave birth during the first week of February.

An initial analysis of the data indicates a positive correlation between winter activity and temperature as temperatures rose above a threshold of ca. 5-10°C. This relationship suggests that vulnerability to human-sources of mortality (e.g., from road crossing, retaliatory killing from livestock depredations) for brown bears in this southernmost part of Europe may increase with continued climatic changes.

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## 10. Discovery of inter-sexual and inter-seasonal differences in the chemical signalling strategies of brown bears

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The brown bear (*Ursus arctos*) is a species which, due to its solitary, dominance hierarchy social system and large home range, is thought to rely heavily on chemical signals as a means of communication. Through camera traps orientated towards bear ‘rub trees’ over a two-year period, we assessed the proportional contribution of scent marking in different seasons by different age sex classes, and gained insights into the role of chemical signalling in maintaining social structure.

We found, during the breeding season (June-July), that both adult males ( $n=38$   $P<0.001$ ) and females with cubs  $>1$  year ( $n=11$   $P=0.003$ ) scent marked trees significantly more often than expected, whereas lone adult females ( $n=7$ ) and subadults ( $n=3$ ) marked less than expected. Outside of the breeding season (August-October), adult males ( $n=70$ ) marked in an expected proportion, females with cubs (all ages) marked significantly more than expected ( $n=71$   $P<0.001$ ), and lone adult females ( $n=11$ ) and subadults ( $n=15$ ) marked less than expected. During both the breeding season ( $n=7$   $P=0.026$ ) and the fall ( $n=11$   $P<0.001$ ), adult females marked trees significantly less than their occurrence on bear trails would expect, as did subadults during the breeding season ( $n=3$   $P=0.026$ ) but not during the fall ( $n=15$ ).

Adult males marked at significantly high frequencies both during and outside of the breeding season, potentially to communicate dominance between males. Supported by the low frequency of scent marking by subadults. We observed a total avoidance of bear trails containing active rub trees by females with cubs  $<1$  year during the breeding season, a possible counterstrategy to sexually selected infanticide due to the strong male bias in scent marking during the breeding season. We hypothesize that scent marking in brown bears is taught by the mother, beginning with cubs  $<1$  year outside of the breeding season at a relatively 'safe' time of year.

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## 11. Activity patterns of Himalayan brown bear in Kugti wildlife sanctuary, Himachal Pradesh, India

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We studied the activity pattern of brown bear (*Ursus arctos*) in Kugti wildlife sanctuary, Himachal Pradesh during 2007-2009. Direct observations were made on bears to collect information on activity patterns. Through focal sampling every 5-10 minute interval, the activities viz. digging, feeding, resting and moving of bears were recorded continuously from 0600h to 2100h ( $n=1513$ ) in different seasons. As brown bear undergo hibernation from mid December to March, three seasons viz. summer (April, May, June), monsoon (July, August, September) and winter (October, November, December) were considered. Brown bear have to spend much more time on feeding for their basic nutritional requirements, especially before and after hibernation. Brown bear were found more active (46.4%) in summer than monsoon (35.8%) and winter (17.8%). They showed maximum digging activity (22.8%) in summer, followed by 10.6% in monsoon and 6.2% in winter. During summer, they spent more time in digging (22.8%) and moving (16.8%). During monsoon, they spent more time moving (11.9%), feeding (11.8%) and digging (10.6%). Whereas in winter, they were not so active compared to summer and monsoon. Brown bear were more active (44.2%) in the evening (1501-1800h) than in the morning (13.6%, 0600-0900h) till noon (13.7%, 0901-1200h) and rest of the day time. During 1501-1800h, they were found active for digging and moving in all the seasons. But in monsoon and winter, they were active mainly for digging and feeding in the evening. The activity of brown bear in general is influenced by various environmental factors, food and human disturbance may be the overriding factors. The study on brown bear is being done for the first time in India and it can be very useful in conservation and management of brown bear population.

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## 12. Movement distance of Asiatic black bears in relation with its foraging behavior, in Nikko-Ashio mountains, Japan

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Recently, Asiatic black bears' (*Ursus thibetanus*, hereafter denoted as 'bear') intrusion to human area has become a major problem in Japan. The abundance of food resource is thought to be the main reason. Especially hard masts have been focused on, and the relation between hard mast production and bear intrusion has been investigated. But intrusion also occurs before the season generally thought for bears to feed on hard mast. Therefore, in this study we investigated the relationship between foraging behavior and movement distance of bears from the season before hard mast (summer) to autumn.

Study was conducted in the Nikko-Ashio mountains, Japan. Three transects were set ranging from 650 to 1000m, 800 to 1200m, 1100 to 1600m a.s.l., with a length of 2km, 2.5km, 2.2km respectively. We searched for feeding signs such as broken branch, claw marks on tree trunk, and feces, 10m within both sides of the transects, every ten days from July to November, 2008 and 2009. GPS collar was fitted and data was collected for six and four bears each year, respectively, to estimate the movement distance.

The bears had a main food which they used intensively for each season. The number of food items consumed increased on periods between when bears changed the main food items. The movement distance can be expected to increase when the food items increased, which will indicate the bears moving around to search for the next main food.

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## 13. Examining reproductive behaviour and range use in Arctic grizzly bears

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Depending on time of year and reproductive status, the importance of available resources and the area traversed in acquiring them can differ between males and females, especially during the mating period. For reproductively receptive individuals, roaming behaviour during the mating period may be advantageous, because of the increased probability of encountering asynchronously receptive mates (i.e., the roam-to-mate hypothesis). To examine roam-to-mate behaviour in Arctic grizzly bears, we used Argos satellite-linked GPS radio-collars to collect location information on movement and range use during mating and post-mating periods from 41 animals in the Mackenzie Delta region of northern Canada. Bears were classed as males, solitary females, females with cubs  $\geq$  one year old, and females with cubs-of-the-year. A two-way ANOVA was used to compare home range sizes by sex and reproductive status across mating and post-mating periods. We found no significant difference in the range size of grizzly bears from the mating period to the post-mating period with the exception of females with cubs-of-the-year that used smaller ranges during the mating period. Our data did not support the roam-to-mate hypothesis observed in other grizzly bear populations and taxa. Only females with young cubs-of-the-year had significantly smaller ranges than all other bears and continued to use smaller areas than males during the post-mating period. Determining how grizzly bears in the Mackenzie Delta use the landscape during mating and post-mating periods has improved our understanding of range use behaviour within the population.

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## 14. Satellite telemetry as a tool to distinguish types of brown bear movements

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Satellite telemetry provides locations of collared brown bears which are precise enough and frequent enough to interpret their movements in quite sophisticated ways. We used the 2-hour spaced locations (GPS/GSM) for nine European brown bears (four females, five males) to define the types of their activities based on the movement patterns. "Hidden Markov model" (Rabiner, L. R. 1989. A tutorial on hidden Markov models and selected applications in speech recognition, IEEE, 77/2, 257-286) was used to detect travelling, foraging and bedding movement modes considering straight line distances between consecutive locations and the turning angles.

The results fit with previous knowledge and showed that bears in Croatia exhibit predominately nocturnal behavior: they travelled an average of 500 m distance at night and 200 m during the day per two hour intervals. More activity was shown in summer and spring: average of 500 m distance travelled in summer and spring comparing to average of 300 m and 200 m travelled during the autumn and winter, respectively per two hours intervals. Males traveled 20% more than females. Travelling mode was dominant at night (64% of night-time) and was decreasing during the day (22% of day-time), while the bedding and foraging modes were the opposite (13% and 23% of night-time to 27% and 50% of day-time, respectively). Presented results do exhibit the potential of exploiting GPS bear location data through "hidden Markov model" and obtain additional understanding and even predictions of bear movements.

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## 15. About of behavior of bear cubs (*Ursus thibetanus*)

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In the Center of rehabilitation of bear cubs-orphans at Ussuri reserve behaviour of 47 bear cubs, at the age of 2 - 8 months was investigated in the period of 1999 - 2007. The accent was placed on trophic, defensive and social phylums of behaviour of bear cubs where categories, forms and positions were defined. Each form of behavior was characterised by key reactions.

**1. Trophic behavior** includes two categories: eating of vegetation and animal feedstuff. Sniffing, turning over, pawing, bending down and breaking of branches (caulises), biting of plant branches and stems in parts, grawing, eating occurs in standing, sitting and lying position on land or trees. Bear cubs eat animal food only on land, the process includes sniffing, pawing, licking, and catching.

**2. Defensive behavior** consists of active- and passive-defensive reactions.



Observation of people and animals take place in sitting, standing position, or lying on land and trees. Concealment occurs in the position of sitting, lying on land and trees. Escaping occurs on land only, attacking can occur both on land and trees.

**3. Social type.** *Contact (integrating) behavior* is motor reactions reflecting positive attitudes among individuals and leading to social integration. It includes cleaning of a partner, grouping, suction of ears can occur on land and trees.

*Remote communication, scent marking* includes friction of body on land, rubbing soil into fur, then shaking. Urination and defecation occur on land and on trees.

*Play behavior includes* climbing up and down trees, swooping on partner - it is similar to attacking, but aggressive movements are often is not finished, jaws in the process of biting are not compressed. Bites do not harm cubs. Play behavior also includes fighting and rolling over on land.

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## 16. Use of caribou calving areas by black bears in Newfoundland

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A recent decline in the Newfoundland caribou population, while likely instigated by density-dependent factors, was exacerbated and is currently maintained by predation on calves, mostly by black bears, but also by coyotes and lynx. To examine how the annual movement patterns of black bears in Newfoundland are influenced by the short-term availability of abundant caribou calf prey in predictable areas, we are radio-monitoring bears in 3 caribou herd ranges where studies of caribou, coyotes, and lynx are concurrent. Preliminary findings suggest that a specific segment of the black bear population is responsible for disproportionate mortality of caribou calves. Collared black bears repeated temporal movement patterns between years. Bears that spent time within the calving areas ( $n = 17$ ) in the 3 study areas during caribou calving and post-calving (the period of peak calf vulnerability) repeated this pattern in succeeding years, whereas all collared bears ( $n = 4$ ) that did not visit the calving areas during this same time period, repeated that pattern in succeeding years. Sex-specific movement rates, tortuosity of travel route, denning distance from the calving grounds, and degree of home range overlap with the calving grounds are examined to evaluate differences that occur between bears that did and did not visit the calving areas during the calving/post-calving period and among study areas and seasons. Results from this and other work will be incorporated into a provincial strategy for caribou restoration.

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## 17. Vocal communication in infant Giant Panda cubs

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The acoustic communication in bears is relatively poorly studied and not well understood. One reason for this is the solitary way of life of all ursid species. Most individuals only vocalize during mating and breeding (although Giant Panda cubs are vocally very active after birth). Recently, considerable research has been done on the vocal communication of Giant Pandas (*Ailuropoda melanoleuca*) in the reproductive context (Charlton et al. 2009). Nonetheless, next to nothing is known about the structure and function of infant vocal signals, the vocal ontogeny and the importance of these vocalizations for early mother-cub social interactions. The present study focused on the acoustic signals of infant Giant Pandas. Acoustic data were recorded on seven hand-raised infant cubs at the panda nursery of the Bifengxia panda base in China. We used 1603 recorded calls to investigate the vocal repertoire. The acoustic analysis was conducted using the phonetic analysis software Praat 5.1.35 DSP package. We classified 5 call types based on acoustic measurements and statistical analysis. We also investigated the behavioral contexts. “Humming”, a vocalization found in all other bear species (Peters et al. 2007), which is thought to signal comfort or contentment and maybe stimulate galactorrhea, could not be documented in infant Giant Pandas. We provide a detailed acoustic description of the vocal repertoire and discuss its possible function in infant Giant Panda cubs. Since the cubs at birth are highly altricial, small in body size, almost naked and blind, acoustic signals may be the predominant channel of communication between the mother and her cubs, besides olfaction and touch.

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## THEME: COLLABORATIVE PROJECTS IN BEAR STUDIES

### 18. Bilingual training videos for field-adapted endocrine techniques: applications for conservation science capacity building

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Empirical data on steroids and their correlates to behavior and physiology is often desirable, but rarely practical, to obtain from free-ranging animals *non-invasively* under field study conditions. Collecting these data in field research is hindered by limited sample storage space, no or intermittent power, costly shipping, necessity of expensive outsourcing, and the complex and lengthy permitting process required for international transport of samples from endangered species and that contain hazardous substances. Fecal steroid metabolite concentrations can provide relevant and accurate, non-invasive proxies for blood steroid concentrations in many bear species. We have developed and adapted simple, easily-trained and effective methods for collecting fecal steroid data that can be readily employed by scientists without prior endocrine experience, or even laymen (i.e., indigenous partners of *in situ* conservation projects). Sample collection, processing and storage is achieved without need for power or complicated equipment. The environmentally-friendly steroid extraction procedure and enzyme-based steroid immunoassays are easily adapted to field sites with at least intermittent power availability. To facilitate transfer of this knowledge throughout the Americas, we are producing a series of free-access, web-accessible training videos, in both English and Spanish, that demonstrate step-by-step all of these simplified, field-friendly methods with low environmental impact. Video training on site will reduce or eliminate the need for international travel to train in an endocrinology laboratory. Training of these simple procedures using free-access bilingual videos, either as a supplement or alone, has profound potential to facilitate technology transfer and science capacity building at an international scale. The initial target audience includes a collaborative *in situ*



conservation project on the Andean bear in Peru, and this video series will help support the training of Peruvian scientists. Once established, video training may be used as a paradigm to support international collaboration and technology transfer for many scientific methodologies

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## 19. Conservation Education Committee- engaging the membership in outreach

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Most of the world's bear species are vulnerable to extinction, and anthropomorphic factors are directly implicated in the decline of these species. Human encroachment continues to influence the conservation status of lesser-known species of bears, and human- bear conflict persists in the developed world where the interface between people and bears is still largely misunderstood by the general public. More recently, recognized stressors like climate change are influencing the distribution of bear populations, altering bear habitat, and may expedite population decline. The International Association for Bear research and Management (IBA) is poised to mitigate the impact of threats to bears through outreach and engagement commonly utilized by conservation biologists working with other charismatic taxa. Education, in conjunction with research and management are the cornerstones of the mission of the IBA. Here we describe the development of a new Conservation Education committee, in which IBA members participating in education and outreach at their respective zoological parks and government agencies will endeavor to extend the reach and strengthen the impact of the IBA conservation message. The Committee's objective is to share information concerning the plight of the extant species of bears at facilities worldwide where the species are housed. The Committee will be comprised of a diverse group of biologists already tasked with conducting outreach. This diversity among members will aid in the development of IBA-assisted education programs for facilities worldwide.

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## THEME: CONSERVATION CASE STUDIES

### 20. The status and conservation of the sloth bear in Rajasthan, India

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The State of Rajasthan, situated at the northwestern part of India, is the largest State of the country. The geographical area of the State is 342239 km<sup>2</sup>, whereas, the total forest area is 32,639 km<sup>2</sup>. The climate varies from semi-arid to arid and physiographically the State can be divided into four major regions namely the western desert, the Aravalli hills, the eastern plains and the south-eastern plateau. Out of the four species of bears in India, the sloth bear have a patchy distribution in the State. The

sloth bear is endemic to the Indian subcontinent and only ursid having myrmecophagous adaptations to feed on insects. Information on sloth bear population was collected from various publications as well as recent records of state forest department. The study gives an idea about the ongoing trend in bear population which, in turn, can serve as a basis for the future conservation needs and planning to conserve the species. Sloth bears are reported to exist in more than 10 protected areas and about 12 territorial administrative divisions of the forest department. In case of territorial administrative divisions only a few divisions seem to have viable populations, whereas other divisions require intensive management to protect the species. Protected areas such as Kaila Devi, Kumbhalgarh, Mt Abu, Ranthambhor, Sawai Mansingh, and Tatgarh Raoli support viable sloth bear populations.

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## 21. Sacred way of conservation of Himalayan brown bear in Pir-Panjal Range, Himachal Pradesh, India

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A unique and excellent way of conservation of Himalayan brown bear were observed in some sacred grazing pastures locally called 'dhars' of Pir-Panjal range falling in Chamba district, where brown bears were found to be protected by migratory shepherds in the name of local deity. Our random survey in 22 grazing pastures/dhars during August and September 2009-2010 along the range revealed that four grazing pastures/dhars i.e. Chadolla, Kundhi Mata, Marali Mata and Diggu-ka-Than were found to be highly sacred where density and encounter rate were found comparatively higher due to protection provided by migratory shepherds in the name of local deity. Recommendations have been made to state Government for promoting this kind of conservation and management of brown bears in other potential habitats along the range and giving incentives to shepherds for protecting brown bears who are potentially facing a precarious future. Detailed methods and sacred way of protection of this kind of unique tribal conservation practices are discussed in this presentation.

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## 22. Locality records of the Sloth Bear *Melursus ursinus* and Malayan sun bear *Helarctos malayanus* in Northeastern India

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Northeastern (NE) India has the distinction of having the limits of world distribution of two species of bears - the Sloth Bear *Melursus ursinus* and Malayan Sun Bear *Helarctos malayanus*. Being at the margins of their range, they are relatively rare and records are few and far between. Since both these species as well as the commoner Asiatic Black Bear *Ursus thibetanus* are black with whitish markings on their chest, local reports are unreliable. Most of the recent publications were unclear about their actual range in the region. However, all have very distinct skulls and foot prints. Moreover, there are records in the past or recent past, which have not been collated as is seen from published literature.

With support from IBA, a study was carried out in NE India. The methods used were a thorough search of published literature and also unpublished materials with Forest departments including old

photos, examination of preserved skulls and museum data besides unpublished data of last two-and-half decade with this author.

The result showed interesting records. The Sloth Bear was recorded both from the plains and hills although not in the high mountains. The easternmost specimens were from eastern Assam but there are reports from as far east as eastern Arunachal Pradesh. Except Kaziranga, there is no recent record from eastern areas. In case of the Sun Bear, its westernmost is Meghalaya's Garo Hills while it occurred widely but sparsely all over but not in the north of the Brahmaputra.

Owing to relative rarity, these two species are relatively better off than the Black Bear, which is heavily poached. The understanding on the range of these bears in their zone of overlap has become better and a clearer picture has emerged. Gaps in the knowledge have been identified for further research.

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## 23. Safeguarding connectivity between brown bear populations in Romania

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As main debates are focused on the “official” size of the bear population in Romania, on methods used for estimation and hunting practices and regulations, the conservation status of a separate subpopulation from Apuseni Mountains was easily overlooked, especially as species distribution on hunting areas suggested that connectivity is not a problem in the Carpathians of Romania.

Our study used a more precise distribution assessment and aimed to evaluate the conservation status of the 244 individuals brown bear subpopulation from Apuseni Mountains. Based on “Guidelines for population level management plans for large carnivores” (Linell, V. Salvatori, L. Boitani (2008); - a Large Carnivore Initiative for Europe report prepared for the European Commission), population size and territory evolution, presence of mortality sinks and connectivity with the main population were assessed.

Extensive field work combined with GIS analyzing identified possible dispersal routes inside a 150 kilometers-long last structural ecological corridor. Sightings of bears outside “traditional” areal in Apuseni were used to evaluate functionality and to prioritize new conservation areas.

The study highlighted the need and urgency for efficient conservation actions and fundamented the proposal of 11 new Natura 2000 sites that, together with existing ones, should form a functional ecological network between Apuseni Mountains and Southern Carpathians.

However, new research paired with conservation and management measures are crucial in order to assure that connectivity will trigger genetic and demographic effects in Apuseni bear population. Safeguarding the existing corridor and creating new ones through ecological reconstruction is essential as habitat fragmentations is a major issue in the context of infrastructure development ongoing at present in Romania.

## 24. Expansion of protection area for the conservation of Asiatic black bear

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Although Asiatic black bears (ABB) have been released in Jirisan National Park since 2004 for the restoration of ABB, it has been posed necessity of co-management for bear's habitat with stakeholder including local government, because their home-range are gradually becoming broader and several threats such as poaching tools are still in existence. So Korea National Park Service extended protection area to the outside of Park and made management plan for more stable habitat.

Protection area was extended considering following factors - the areas ABBs have stayed and passed (based on radio tracking result between 2004 and 2010), - deciduous broad-leaved forest including oak tree and mixed stand forest, - the areas minimum 300~500m far from the threats such as residential area, farmland and load etc., - expected areas ABB move to another neighboring habitat (Deokyouisan National Park). And that is classified into core conservation area, buffer area and flexible transition area. and its management plan may be summarized as follows. Establishment of special management zone for the prevention of poaching tools, installing of electric fence on the expected damage areas from the bears, reinforcement of ABB restoration community's role, making of several huge eco-bridge among the fragmented habitats and purchase of private land in National Park. However management plan and great protect area will be adjusted through the continuous monitoring and research.

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## 25. Asiatic black bear restoration for the recovery of healthy ecosystem in Korea

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Although in the past lots of Asiatic black bear inhabited in Korea, the size of populations were decreased because of poaching and habitat loss, they became a endangered species. Hereupon, It was suggested the restoration project of Asiatic black bear by Supplementation, In 2001, four captive cubs with radio transmitters were released experimentally to confirm whether the Asiatic black bear could adapt to the environment of Jisan National Park (JNP) and to study reintroduction methodology.

As a result of that we could obtain lots of information for the restoration of Asiatic black bear in Korea and it has started introduction and releasing of bears from Russia and North Korea which were distributed same subspecies (*Ursus thibetanus ussuricus*) with Korean Peninsula since 2004 (total 30 bears\_2004; 6 cubs, 2005; 14, 2007; 6, 2008; 1, 2009; 2, 2010; 1).

Every bear was quarantined and released with transmitter or GPS collar. Although all of the released bears adapted well to the wild and hibernated, a few had become so habituated to people that 4 of these were eventually withdrawn and 11 were died. However 2 bears gave birth 1 cubs respectively, so totally 17 bears alive in JNP except for wild bears (Nov. 2010).

The restoration of endangered species is long-term project and for the success we have to approach with interdisciplinary vision, it is estimated that the restoration of Asiatic black bear in Korea is going along well because of following reasons (1. bear didn't only find winter den by themselves, hibernated successfully, but also mated and gave birth, 2. It is established a government-affiliated organization (Species Restoration Center of Korea National Park Service) which conduct synthetically restoration of endangered species including Asiatic black bear.3. It is settled prompt compensation system on the damage from released bears and damage prevention service. 4. It is been running continuous monitoring system after releasing)

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## 26. Veterinary support for the successful restoration of Asiatic black bear

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As a restoration of endangered species is one of the biggest efforts for the conservation of nature, it is needed interdisciplinary speciality and veterinary support is essential part especially. On the restoration of Asiatic black bear (ABB) in Korea it has supported quarantine and health screening of ABB from the outside, anesthesia for the transportation and exchanging of transmitters, rescue and treatment of injured bears, captive breeding, physiological research and autopsy on the corpse. Actually we could detect parasitosis (*Baylisascaris transfuga*, *Toxocara canis*), ehrlichiosis, canine distemper, dermatomycosis etc. through the disease screening on 29 ABBs from the other country (North Korea, Russia) between 2004 and 2010, by releasing of the bears after treatment it could be protected transmission of the pathogens to the country. And through the rich experience of anesthesia and plenty of blood collecting on the ABB we could make optimized ABB anesthesia protocol and blood chemistry standard value. Besides active rescue of the injured bears (14 times of 29 released ABBs) has done much to decrease the mortality rate. Likewise, veterinary support on the restoration of endangered species could be approached in various ways, and now in Korea restoration of Amur goral (*Nemorhaedus caudatus*) and red fox (*Vulpes vulpes*) are also on the march on the basis of the know-how it had accumulated in ABB.

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## 27. Brown bear behavior and human activities inside and outside protected areas

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The endangered Cantabrian brown bear population, NW Spain, is divided in two subpopulations separated by human infrastructures and development that limit communication between them. Much of bear range is inside officially protected areas such as Natural Parks and/or Biosphere Reserves, but some important areas where bear reproduction has been confirmed in recent years are not officially protected. These areas are important because they may reduce the distance separating both subpopulations.

During the period spring 2010- spring 2011, we are doing fieldwork in 4 areas inside bear range that have different degree of protection. Two areas are inside Natural Parks, and 2 are not protected areas. We describe and quantify human activities and bear behavior in these areas aiming to estimate the influence of human activity on the bears. We perform sitting and waiting sessions in every area on a weekly basis, recording the behavior of observed bears (e.g. time allocated to feeding, walking, playing, resting, vigilance, running away) and human activities (e.g. hunting, livestock handling, hiking, etc). Besides, we develop a pilot study on hormone levels measured in bear scats. This physiological approach can provide information on bear condition.

Connecting both subpopulations is essential for the long term survival of Cantabrian bears. Indeed, that is a goal established in all recovery plans. After evaluating the role of currently protected areas on bear conservation, this study will end up with recommendations to improve habitat management in terms of land and public uses. This may help shortening the distance between subpopulations by providing specific areas with adequate protection measures.

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## 28. Population monitoring in Southeast Asia - signs in the jungle provide a simple tool for guiding bear conservation

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Monitoring trends in bear numbers is necessary to inform and adapt current conservation strategies, and to highlight the need for new conservation programs. In the developing nations of Southeast Asia, an ideal bear monitoring program should be applicable over a large geographic area and adequately reflect changes in numbers of animals, yet be relatively inexpensive and require a low level of expertise, so can be implemented by current staffs that monitor and patrol forests. A caveat for bear monitoring in this area is that there are 2 species of bears (Asiatic black bear and sun bear), which although sympatric may undergo different population trends; therefore, monitoring must be species-specific. As both species leave visible signs in the forest, much of which (i.e., claw marks on trees) can be distinguished to species, sign surveys seem to fit the criteria for a suitable monitoring method.

In April 2007 I attended a bear sign survey training course in Cambodia, taught by members of the IUCN Bear Specialist Group. After this training, I went on to implement surveys in Cat Tien National Park (CTNP), Vietnam, and Bokeo National Park (BNP) and Nam Et Phou Louey (NEPL) National Protected Area (NPA), Laos. In CTNP, Asiatic black bears were thought to have become locally extinct until sign and interview surveys proved otherwise. In BNP, sign surveys were used to guide a bear release pilot study. In NEPL we collected baseline data for future monitoring while demonstrating the potential for well managed NPA's to maintain high levels of bear activity. My research now continues in other sites in Laos. Here I report results of these surveys in terms of relative densities of bears among areas, habitat suitability, species-specific habitat use, identifiable threats, and implications for conservation.

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## 29. Global perspectives on polar bear status and conservation

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We examine the status of polar bears from a global perspective and derive a global population estimate based on subpopulation density estimates and ecosystem correlates. The global polar bear population estimate of up to 25 000 animals is poorly established. We use sea-ice features typical of polar bear habitat, such as coastline length and complexity, the ratio of land to water, and bathymetry to define polar bear habitat. We also investigate the connection of polar bear distribution to ocean productivity using chlorophyll-a as an indicator of habitat quality. We then tie habitat quality to subpopulation density in regions where polar bear abundance is well-established and extrapolate to regions where data are unavailable, ultimately arriving at a range of population estimates for the entire Arctic. Based on our new estimates, we examine the subpopulation regions in terms of conservation status. We consider recovery potential of polar bears in different subpopulations based on future predictions of multi-year sea ice cover and increasing ice-free periods, but also in terms of productivity and prey diversity. We identify key needs for further study with respect to improving population estimates and conservation efforts. Furthermore, we examine the existing protected areas and approaches to protection established by the five Arctic nations (Canada, USA, Norway, Russia, and Greenland/Denmark) and make recommendations for Canada based on our findings.

### 30. Preliminary diagnostic of the condition of the population of Andean Bears (*Tremarctos ornatus*) in the Serranía de Perijá: a Colombian-Venezuelan binational compromise

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North South-America Andean Bear's population is shared between Colombia and Venezuela, at the Serranía de Perijá (Colombian Guajira and Cesar Department's, and Venezuelan Zulia State). There are resident bear populations just at the south of the Santurban's area; also in Cesar and Guajira departments the bears's presence is seasonal. This population is isolated in both countries and faces threats as high level of extraction of bears, hunting, and habitat degradation due to mining effects and illicit crops of amapola in the Venezuelan side. Even though this area has two National parks, the forest in Colombian side has mostly disappeared compared to Venezuelan side's, where is well preserved. Through forest field's walks, and based in popular information about bear's presence, it was search activity signs that proved the specie's continuance, each sign was allocated by a rough age. By interviews and carcasses' recuperation, the number of hunted animals in 30 years period in both sides of the Serranía was estimated. In the Colombian area, an average of 6 bear's killed annually and 4 cubs bear extracted was reported in this period. In "las antenas", Venezuela, it was reported the finding of 6 - 8 bear carcasses on two opportunities in a decade; Ritual, medicinal and pet uses are common, also, it was presumed some traffic to the Asiatic market.

Corpoguajira and Corpocesar (Colombian organizations in charge of Andean Bear protection in the country's Northeastern) have developed some conservation strategies, but bear's population stability at the National parks is endangered due to agricultural policies in Venezuela and social violence and mining in Colombia. Although the presence of a Yukpa reserve in Venezuela and the strict wildlife management policies in Colombia contributes to Andean bear conservation, however the low monitoring and lacks in control alternatives, makes the Andean Bear population's conditions in this area are insufficient and unknown.



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## 31. Rapid evaluation of spectacled bear presence in a private conservation area in the department of Amazonas, Peruvian Northern Andes

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Spectacled bear (*Tremarctos ornatus*) is a flagship species that is endangered by the deforestation, agriculture development, mining and poaching. In relation to distribution range and population, Peru has bigger wild population in comparison to other countries. Nevertheless, a few research and conservation projects are being carried out currently in Peru, focused in species ecology and conservation, and are carrying out in some places with different ecosystems and realities, in the dry forest of lowland areas in northwest Peru (Lambayeque) and the cloud and mountain forest in the Peruvian southeast (Apurímac and Cusco). Despite of being great initiatives, it is necessary to carry out more studies to know the occurrence and the ecology of the species in the country, because exist a variety of ecosystems and territories for their distribution in Peru. The aim of our preliminary study was to identify the presence of *T. ornatus* in the montane forest at the Peruvian northeast Andes. We worked in the Private Conservation Area (PCA) “Huiquilla”, located in the Province of Luya, Department of Amazonas (6°23' S, 7°59' W). This conservation area comprises around 1,140 hectares of protected Andean humid mountain, clouded forest and paramo grassland from 2,500 to 3,300 m. of altitude. The work carried out during September 2009 in the end of dry season until March 2010 in the end of rainy season. We evaluated ten locations of the PCA with the use of transects and the installation of camera traps. In each one available transects was walked by 2-3 days. Along transects was recording the different types of Spectacled bear signs: scat, footprints, tree nests, scratch marks, feeding sites, beds and bear paths. We found several feeding sites around of all sample points, with more prevalence of bromeliad plants of the genus *Tillandsia* in the mountain forest, and *Puya* in the paramo grassland. With the use of the camera-trapping method, Spectacled bear was not recorded clearly, but were identified some mammal species that comprises their diet, as the mountain paca (*Cuniculus taczanowskii*) and northern pudu (*Pudu mephistophiles*). At the same time were identified other carnivores that are competition: mountain puma (*Puma concolor*) and margay (*Leopardus wiedii*). The results of this preliminary study showed a higher prevalence of Spectacled bear sings in all the evaluated sample points, and increase the knowledge on distribution of *T. ornatus* in northern Peru. This study is being funded by The Scott Neotropical Fund, of the Cleveland Metroparks Zoo and Cleveland Zoological Society.

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## THEME: ECOLOGY AND BEHAVIOUR OF POLAR BEARS

### 32. Polar bear distribution with respect to sea ice in western Hudson Bay

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Habitat defines an area where the resources and conditions allow occupancy by an organism. The presence, abundance, and distribution of a species are largely influenced by the quality and



characteristics of available habitat. Polar bears (*Ursus maritimus*) inhabit ice-covered waters of the circumpolar Arctic, a very dynamic environment. Thus, we would expect habitat selection by polar bears to be highly variable across space and time. The sea ice in Hudson Bay, Canada, has been melting earlier than normal in recent years in response to climate warming. These changes have resulted in documented declines in the condition, survival, and abundance of polar bears in western Hudson Bay. The objectives of this study are to: 1) quantify patterns of polar bear habitat-use on the sea ice in Hudson Bay to understand habitat selection, and 2) analyze long-term distribution patterns to determine how polar bears have responded to changing sea ice conditions. We deployed GPS collars and analyzed data collected from 2004 to 2011. Polar bear utilization distributions, which estimate the probability of use by an animal throughout its home range, show strong seasonal variation. To improve our understanding of habitat-use by polar bears and the energetic implications of changes in movement patterns, we will make detailed examinations of monthly distributions of the bears in relation to the sea ice and will examine temporal changes in activity centers. Monitoring space-use patterns over time will allow us to understand how changes in sea ice in Hudson Bay may alter habitat selection by polar bears.

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### 33. Predicting polar bear habitat in western Hudson Bay

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Sea ice in Hudson Bay is critical habitat for three overlapping populations of polar bears (Foxye Basin, Western Hudson Bay, and Southern Hudson Bay). Body condition and survival of the Western Hudson Bay population has declined over the past 30 years as a consequence of earlier sea ice break-up and later ice formation that has increased the on land fasting period by one week per decade. The goal of this project is to predict future changes in polar bear habitat under continued warming using scenarios produced by the Canadian Center for Climate Modeling Analysis, third generation climate model (CGCM3). Our objectives are to validate a high-resolution coupled sea ice model and use this model to predict changes in the sea ice parameters that are closely related to polar bear ecology (e.g. ice concentration and thickness). The model is a simple version of the FESOM, in which the ocean component has been simplified to a 2-D mixed layer of fixed depth. We validated the model with sea ice observation data from the Canadian Ice Service, and with GPS satellite telemetry data collected from polar bears in western Hudson Bay. We then predicted future trends in ice parameters, and seasonality under three global warming scenarios.

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### 34. Shifts in land-based foraging by polar bears in western Hudson Bay during the ice-free season

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According to current climate trends, spring ice breakup in Hudson Bay, Canada, is advancing rapidly, leaving polar bears (*Ursus maritimus*) less time to hunt their primary prey, seals, during the period

when they accumulate the majority of their annual fat reserves. For this reason, foods polar bears consume on land during the ice-free season may become increasingly important, potentially helping to compensate for energy deficits from lost seal hunting opportunities. From 2006 to 2008, we collected 642 piles of polar bear feces from 160 km of coastline in western Hudson Bay and 6 inland areas to develop a comprehensive inventory of summer diet. We compared these data to a study from 40 years ago (Russell 1975) to characterize how the diet has changed since the onset of climate changes. We also examined the types of foods polar bears consume together and the spatial and temporal patterns of occurrences across the study area. Results indicate that the most common foods currently consumed (as a % of scats containing them) are grasses (57.0%), kelp (46.1%), birds (29.0%), moss (13.6%), caribou (*Rangifer tarandus*) (10.1%) and mushrooms (8.9%). Plants and animals were often found together (34.3%) and in various combinations. There is much overlap between the current and past diet but we found new foods (caribou, eggs) and marked changes in the frequencies of others. Increased foraging on lesser snow geese (*Anser caerulescens caerulescens*) and caribou, for example, coincide with dramatic changes in their local abundance and distribution since the 1960's. Similarly, foods currently consumed across the study site were found in proportion to where and when they were most available, which suggests an opportunistic approach to foraging. Given our data and numerous field observations, we discuss the potential energetic value of pursuing land-based prey as well as including vegetation in the summer diet.

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## 35. New insights for the polar bears of Baffin Bay: using additional harvest data to assess changes in survival

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The population of polar bears in Baffin Bay, shared by Greenland and Canada, was last surveyed between 1993 and 1997; resultant vital rates at that time suggested a productive population. Subsequent simulations incorporating harvest indicated a decline from 2,074 to 1,546 individuals by 2004. Out of concern for the putatively declining population, international trade in polar bear hides from Baffin Bay has been reduced including a ban on export from Greenland and ban on import of hides into Europe from Canada. Greenland reduced harvest in 2006, and beginning in 2010, quotas were decreased in Canada. The status of Baffin Bay polar bears is controversial as local Canadian residents who harvest bears for subsistence and also guide sport hunters have suggested the population has increased. Scientists are hesitant to draw conclusions on population status due to the dated survey data, and given average annual sea ice concentration in Baffin Bay has declined 9% per decade with unknown consequences for population viability. We used 1,418 captures of 1,225 polar bears (1979-1997) and their recovery (289 marked bears harvested 1979-2009, including 99 bears since the initial study) in a live-dead model to update survival rates for the Baffin Bay population. We constructed survival, capture and recovery submodels using sex, age and time factors in the RMark interface using R (running models in MARK). Model-averaged survival (from two models with  $\Delta AICc < 2.0$ ) of polar bears in Baffin Bay have declined (0.86 (0.16 SE) and 0.90 (0.14) in 2009 for total and natural survival, respectively, of adult females). Harvest rates are ~9 and 4% for adult males and females, respectively. New survival estimates have a high variance due to declining recovery of marks, and as they were generated from recovery data only. We will discuss the results, and the biases and precision of the estimates.

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## 36. Use of Brownian bridges to identify areas of common space use of polar bears in Southern Hudson Bay

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Hudson Bay goes through a complete cryogenic cycle each year, completely freezing over each winter with ice forming in late November or early December, and typically melting by late July. During that time, there are few geographic barriers that serve to limit polar bear (*Ursus maritimus*) distribution or movement. Polar bears are a highly mobile species, capable of covering many hundreds or even thousands of kilometres each year in search of food. We used GPS/Argos telemetry collars to track individual bears for 1 – 2 years from 2007 – 2011, collecting high accuracy GPS positions every 4 hours. Using a Brownian Bridge movement model, we generated a seasonal Utilization Distribution (UD) for each bear. We compared common space use between bears and between reproductive classes using a Utilization Distribution Overlap Index (UDOI). The UDOI provides a measure of quantifying space-use sharing between individuals. By quantifying space-use sharing of polar bears we can begin to better understand space use requirements throughout the winter, and how future changes to ice distribution and concentration due to climate change may affect their seasonal distribution and movements in Hudson Bay.

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## 37. Polar bear (*Ursus maritimus*) maternity denning habitat in the Hudson Bay Lowlands of Ontario: present and future

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Due to the cycle of complete melting of sea ice in Hudson Bay in summer, all polar bears are forced ashore for up to 5 months, and pregnant females for up to 8 months. While ashore, the bears undergo an energetically expensive prolonged fast. Since sea ice does not re-form in Hudson Bay before pregnant females give birth to litters of cubs in December, all maternity denning in the Hudson Bay ecosystem occurs on land. In the Hudson Bay Lowlands of Ontario, pregnant females construct dens in features characteristic of permafrost regions such as palsas and frozen peat banks of small lakes. Other sites used are river banks, eskers, and beds in the lee of clumps of spruce trees. Most maternity dens are constructed in frozen peat in the sides of palsas > 1.5 m high, or in similar height peat banks of small lakes. The distribution of permafrost in the region is predicted to decline by 50% by 2100. How polar bears will adapt to loss of permafrost features is unknown, though some bears apparently den successfully in other sites. It may be that denning in palsas and peat banks offers an energetic advantage to the pregnant female; if so, then pregnant females will have higher energetic demands during winter hibernation in the future. Body condition of pregnant females has already declined in the Southern Hudson Bay subpopulation since the mid-1980s, and survival rates of all age and sex classes have declined, presumably related to earlier sea ice melt and loss of hunting opportunities. The additive effects of loss of hunting opportunities and increased energetic demands during hibernation are expected to have major effects on reproductive success and perhaps even adult female survival.

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## THEME: FORAGING STUDIES

### 38. Foraging of the brown bear (*Ursus arctos*) on the various tree species in Polish Carpathians

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Use of tree juice as food by bears is known in Europe and America. In America it is a typical way of feeding of black bear *Ursus americanus* (Nolte et al. 2003), whereas in Poland this issue has been only partially investigated (Zysk-Gorczyńska, Jakubiec 2010, Jakubiec 2001). Peeling off the bark and foraging on a phloem has been observed in Poland since 1991 but is still one of the least known aspects of bears' foraging behavior. In Poland, damages are being done mostly on coniferous trees, such as fir (*Abies alba*), spruce (*Picea excels*) and larch (*Larix deciduas*). Damages on hardwood trees such as ash (*Fraxinus excelsior*), maple (*Acer platanoides*) or oak (*Quercus robur*) are relatively rare. Detailed studies of this aspect of brown bear behavior have been conducted in Poland since 2004 and included: (1) the analysis of tree stands peeled off by bears (composition and age of stands, tree height, display, pH and soil fertility), and (2) the analysis of the ways of how bears peel off the trees (traces of bark strips, tree exposition, characteristics of foraging marks). This research was complemented with the analyze of the potential ecological role of the injured trees and economic aspects in forest management. Additionally, the collection of tree juice is done to estimate the value and chemical composition. In this study about 900 of trees were measured.

Foraging of bears on tree phloem occurs relatively often but in Poland it is still one of the least investigated aspects of behaviour of these animals. Much more often observed indication of bears' activity is leaving different spoors and marks, such as scratches on trees.

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### 39. Getting to the root of the matter: grizzly bears and alpine sweetvetch in west central Alberta

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#### Research Objectives

The objective of this research is to examine the spatial and temporal variation in the nutritional quality of alpine sweetvetch roots (*Hedysarum alpinum*), which is an important spring and fall food resource for grizzly bears (*Ursus arctos*) in west-central Alberta, and to develop predictive models of alpine sweetvetch nutritional quality on the landscape. The relationship between peak nutritional quality and use/selection of sweetvetch habitats will also be explored using GPS telemetry information, to see if grizzly bears associate themselves with higher quality patches and thereby exhibit resource tracking behaviour. This project will take a new approach to resource selection models in that we will rescale the predicted distribution of a plant food resource patches to predicted nutritional quality within patches.

## Methods

Alpine sweetvetch roots (n = 126) were collected from 2008-2010 and analyzed for percent crude protein. Further analysis for total dietary fibre (TDF), fat, and available carbohydrate will be undertaken in December 2010. Candidate variables were used to construct general linear models (glm) for crude protein content based on a priori hypotheses, with the best model chosen using Akaike Information Criteria (AIC). The crude protein model is currently being used to create bi-weekly GIS layers that predict protein content over the study region. Analysis of *H. alpinum* patch use/selection will take place in December 2010, using GIS telemetry data from Foothills Model Forest and MODIS snow cover data. Models for TDF and carbohydrate will be completed in January 2011.

## Preliminary Results

The crude protein content of alpine sweetvetch was best modelled by Julian day, compound topographic index, and growing degree day. Bi-weekly maps are indicating high variability in crude protein content of *H. alpinum* roots over space and time, with alpine and sub alpine regions having higher average protein levels than lower elevation patches during the spring.

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## 40. Food habits of the southern population of Asiatic black bears in Japan

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Because of its wide geographic distribution, the Asiatic black bear is expected to show wide variation in its food habits, and studying the geographic variation in diet is important to discuss the habit requirements and evolution of this species. In Japan, Asiatic black bears are distributed over 10 degrees of latitude, and the dietary difference between the north and south is expected to be large. However, while the northern population has been studied in depth, the food habits of bears in the south are not clear. Food habits influence bear movement to a great extent. In the north, the production of beechnuts is highly correlated with the mass intrusion of bears into human residential areas. However, the key food resource that influences such intrusion in the south is not known and must be determined to establish management policy.

We studied the food habits of bears in the south by analyzing feces collected from 1998 to 2005 and in 2010. The proportion of food items consumed was evaluated quantitatively by calculating the percent importance values. This analysis showed that the bears tended to consume food with less fibre, high nutritive value, and high availability in each season, similar to the tendency seen in northern bears. Of note, the bears consumed a high percentage of beechnuts in the fall of 2010, when the beechnut production was high, but many bears still entered residential areas, unlike the relationship between beechnut production and bear intrusion in the north. This might have occurred because the beechnut forest cannot provide enough food for many bears, even in a high-production year, because of restricted forest distribution. The dietary characteristics in a mass-intrusion year included a much lower percentage of *Quercus* acorns and *Cornus controversa* fruit than in ordinary years, which might be the key food resources influencing the occurrence of mass bear intrusions in this area.

## 41. Food habits of highly dense population of sloth bear in Mount Abu wildlife sanctuary, Rajasthan, India

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We studied the food habits of highly dense population of sloth bear (*Melursus Ursinus*) in Mount Abu wildlife sanctuary, Rajasthan. A total of 469 scats were collected during 2007-2010 and analysed for the food remains to determine the percentage frequency of food items in the diet of sloth bear. Food remains and other hard parts present in the scats were identified through reference materials. The analysis of 469 scats, comprising 147 scats of summer season, 197 scats of monsoon and 125 scats of winter, revealed 21 distinct plant species and five insects in the bear diet. The plant matter and animal matter constituted 58.8% and 41.2% of the diet of sloth bear parts throughout the year. Among plant matter, the frequency of occurrence of *Ficus* species was highest (48.2%), followed by *Lantana camera* (34.9%), *Phoneix sylvestris* (4.9%), *Carissa karonda* (4.3%), *Mangifera indica* (4.1%). Among animal matter, the frequency of occurrence red ants was highest (23%), followed by black ant (20.9%), termites (14.9%) and other insects. *Ficus* species were consumed maximum during summer (40.8%) and monsoon (35%), whereas *Lantana camera* was consumed maximum during winter (68.8%), followed by monsoon (23.9%) and summer (21.1%). The frequency of red ant and black ant was highest during monsoon (49.8%). The frequency occurrence of the plant and animal matter showed distinct variation in different months. The percent dry weight of food items during summer (55.5%), monsoon (56.5%) and winter (57.3%) in scat samples was almost the same. In all the three seasons, the percent weight of plant material was more than the animal matter. Sloth bear were also found to consume *Psidium guajava*, *Zea mays*, *Triticum aestivum*, *Sorghum bicolor* and vegetables. The feeding habit of sloth bear was found to be largely dependent on the availability of food resources in different seasons.

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## 42. Diet of the brown bear in Himalaya: combining classical and molecular genetic techniques

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The ecological requirements of brown bears are poorly known in Himalaya, which complicates conservation efforts. We documented the diet of the Himalayan brown bear by combining classical scat analysis and a newly developed molecular genetic technique (the *tmL* approach), in Deosai National Park, Pakistan. Brown bears consumed over 50 plant species, invertebrates, ungulates, and several rodents. Eight plant families; Poaceae, Polygonaceae, Cyperaceae, Apiaceae, Asteraceae, Caryophyllaceae, Lamiaceae, and Rubiaceae were commonly eaten. However, graminoids made up the bulk of the diet. Golden marmots comprised the major mammalian biomass in the park, and were also the main meat source for bears. Animal matter, making 36% of dietary content, contributed half of the digestible energy, due to its higher nutritious value. We did not find a significant temporal pattern in diet, perhaps because the availability of major diet (graminoids) did not change over the foraging period. Male brown bears were more carnivorous than females, probably because of their larger size, which requires higher energy and also makes them more efficient in capturing marmots.



Frequencies of three plant species were also significantly higher in male brown bears; *Bistorta affinis*, *Carex diluta*, and *Carex* sp. Diet of the brown bear differed significantly between the park and surrounding valleys. In valleys, diet consisted predominantly of graminoids and crops, whereas the park provided more nutritious and diverse food.

The estimated digestible energy available to brown bears in Deosai National Park was the lowest documented in brown bear populations, due to the lack of fruits and a relatively lower meat content in the diet. The low nutritious diet and high cost of metabolism in a high altitude environment, probably explains the very low reproductive potential of this population.

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## 43. Food habits of sloth bears and sloth bear-human conflict in Sanapur Forest, Karnataka

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Sanapur forest is characterized by a stretch of rocky mountains with scrub vegetation, a typical of Deccan plateau. Conservation attention was limited in the area due to the poor forest cover, leading to the increase in quarrying and mining activities and habitat degradation. A study was carried out on the ecology of sloth bears *Melursus ursinus* in Sanapur forest during 2007. Scat analysis (n=161) found that sloth bear feed on 24 species which includes 17 plant species and 7 animal species. Sloth bears primarily feed on termite (19.3 %), *Zizyphus oenoptia* (18 %), *Grewia salvifolia* (15.4 %) and *Grewia tiliifolia* (11.8 %). Presence of four cultivated plants in the diets; namely rice *Oryza sativum*, bajra *Pennisetum glaucum*, jowar *Sorghum bicolor* and ground nut *Arachis hypogaea* indicates that sloth bears raids on crops. Seasonal analysis showed variation in the dietary pattern of sloth bears. Main diets during summer include termite (22.5 %), *Grewia tiliifolia* (12.5) and *Cassia fistula* (20 %); winter main diets were *Zizyphus oenoptia* (24.8 %), termite (18.5 %), *Grewia salvifolia* (17.6 %), monsoon main diets were termite (19.4 %), ant (16.1 %) and *Lantana camara* (12.9 %). The bear-human conflict was low. Study recorded 7 persons attacked by the bears between 2003 and 2007. Future study can be aimed at understanding the population dynamics of the sloth bear, range size, sampling the vegetation to quantify the available food resources, and identifying the potential habitats of the animals. The survival of sloth bears depends on addressing the conservation problems and conserving the habitat.

Key words: sloth bears *Melursus ursinus*, Deccan, quarrying, mining, survival, range, habitat

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## 44. Food habits of Himalayan brown bear in Kugti wildlife sanctuary, Himachal Pradesh, India

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The natural local food habits of Himalayan brown bear (*Ursus arctos isabellinus*) were investigated by analyzing 222 scats and by 57 feeding site observations (37 hours of direct observation, 78 minutes video footage on foraging activities) during 2004-2006 in Kugti wildlife sanctuary of Himachal Pradesh. During summer, monsoon and fall, the frequency occurrence of animal matter was 27.8%, 23% and 9% respectively, and the frequency occurrence of plant matter was 72.2, 77% and 91% respectively. All these dietary composition revealed that the frequency of occurrence of plant matter was higher than the animal matter in all the seasons. Bears fed primarily on *Rumex nepalensis* after emergence from hibernation and dug for roots of *Selinum vaginatum*, *Geum elatum*, *Typhonum seginatum* (tubers), and *Morchella esculenta* (fungi). In addition to eating plants, brown bears also killed sheep and goat in sub-alpine and alpine areas when livestock is available (May-October). The animal matter was found to be comprised of insects, ants and unknown items including hairs, bones, jaws, teeth, claws and nails in the bear diet. The annual frequency occurrence of plant matter in the scats of brown bear was 79%, and its major part (58.3%) was comprised of unknown plant matter. The plant matter eaten by brown bear comprised of 10 confirmed plant species. Based on 57 direct feeding observations, brown bears were found feeding on 29 species of herbs including agricultural crops like *Hordeum vulgare* (seeds), *Fagopyrum esculatum* (seeds) and *Zea mays* (seeds)

There is little information on the ecology of Himalayan brown bear in India hence seasonal food habits information is important because it reflects seasonal trends in brown bear habitat use and for their effective management, particularly under the increasing encroachment of potential bear habitat by nomadic shepherds.

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## 45. Predicting changes in habitat condition for grizzly bears associated with mountain pine beetle management in Alberta

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Habitat alteration from industrial development may regulate bear populations indirectly by influencing the availability of food resources. In Alberta, the forestry sector plays a major role in shaping grizzly bear (*Ursus arctos*) habitat because of the large areas of mature forest harvested every year. With the arrival of mountain pine beetle (*Dendroctonus ponderosae*), plans are in place to increase annual harvesting levels over the next twenty years and convert stands of mature lodgepole pine (*Pinus contorta*) to younger age classes. To assess the impacts of harvesting on grizzly bear food supply, we spatially mapped changes in herbaceous and berry biomass as a function of stand age and environmental conditions. We focused on major food items known to be important to grizzly bears including horsetails (*Equisetum spp.*), cow parsnip (*Heracleum lanatum*), huckleberry (*Vaccinium membranaceum*), velvet leaf blueberry (*Vaccinium myrtilloides*), dwarf blueberry (*Vaccinium caespitosum*), and ligonberry (*Vaccinium vitis-idaea*). Our results suggest that herbaceous biomass will increase as the age distribution of pine shifts to younger age classes. However, the effect of pine age on berry biomass was far more complex because there was strong year effect interacting with stand age. On average, total fruit biomass decreased by 66% from 2008 to 2009 irrespective of age. Comparing total berry biomass from regenerating and mature stands, in 2008 there was 30% more berries in regenerating forest while in 2009 there was 50% more berries in mature forest. Overall, in 2009 we observed a 55% reduction in total berry biomass within mature stands and an 83% reduction in regenerating stands. We believe that a 20% reduction in growing season precipitation in 2009 likely explains the year effect. We conclude that in productive years, regenerating forest contains substantially more berries than mature forest; however, in years when fruit is not abundant, mature stands may be an important source of fruit for grizzly bears.



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## 46. Ungulate consumption in grizzly bears is influenced by open-pit mining

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Use of ungulates by grizzly bears has been poorly documented in industrially modified landscapes and in forest dominated environments where direct observations on bears are precluded. We researched bear consumption of ungulates by visiting a sample of GPS locations acquired remotely from radiocollared adult grizzly bears in west-central Alberta. In 2008-2010, we captured 10 adult bears on and around 2 reclaimed open-pit coal mines to assess whether mine sites are important predation areas for bears, based on high ungulate densities on mines. We investigated 550 GPS location clusters and found ungulate carcasses at 137 clusters on and around mines. Ungulate consumption was a result of predation by grizzly bears or scavenging on wolf, cougar or hunter killed ungulates. On ecologically reclaimed mines in the study area, which have vast open spaces that attract ungulates, most kills were located on edges between moderate or dense coniferous cover and open grasslands. Outside mines, most carcasses were found in open coniferous habitats associated with river valley systems. Elk and moose represented the majority of carcasses, with moose found exclusively outside mines. Of kills found on mines, elk calves were the predominant species and age class. Bighorn sheep and deer were taken to a smaller extent. Substantial variation existed between bears, with some individuals consuming more ungulates than others. Differences existed between seasons as well, with most bears preying on ungulate calves and lambs in spring and early summer and having another peak of ungulate consumption in the fall. During the sport hunting season, bears frequently scavenged on ungulates killed by hunters along roads and trails outside mines. Using habitat characteristics and ungulate distribution data, we assessed whether different patterns of ungulate use are indicative of predator specialization, or are a reflection of habitat and ungulate availability on the landscape.

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## 47. Optimal foraging in brown bears: the biogeographical and local approach

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We reviewed 28 studies on brown bear *Ursus arctos* diet to examine the dietary patterns of the species across its range in relation to geographical and environmental factors. At local scale, we investigated the seasonal variation in bear diet in the eastern Polish Carpathians at individual and population level based on the analysis of ca 1000 scats. We distinguished six main food categories: green vegetation, fleshy fruits, hard mast, supplemental food, insects and vertebrates. We also investigated the activities of radio-collared bears (n=4) by immediate field-inspection of GPS telemetry locations. Among bear activities, we distinguished resting, walking and foraging on six food categories. We related the seasonal share of food categories in bear diet to the amount of time bears devoted to different activities.

At a biogeographical level, temperature and snow conditions were the most important factors determining the composition of brown bear diet. Populations in locations with deeper snow cover, lower temperatures and lower productivity consumed more vertebrates and less invertebrates and mast. Environmental conditions, especially climatic factors, shape the nutritional and energetic requirements of bears as well as the local availability of food.

In the study area, activity and diet patterns of brown bears changed seasonally. In the spring, bears concentrated their foraging activity on ungulates and supplemental food, which constituted the staple part of the consumed biomass. In summer and early autumn, the diet of bears consisted almost exclusively of fleshy fruits, though they devoted less than 50% of time to feeding on them. The share of hard mast in autumn diet was relatively low when compared to the amount of time spent feeding on them. The percentage of insects in the consumed biomass was also lower than expected from the amount of time devoted to foraging on them in all the seasons.

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## THEME: GENETICS STUDIES OF BEARS

### 48. Non-invasive genetic sampling of Polar bears (*Ursus maritimus*)

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There is a need to develop less-invasive methods to collect information for the management of polar bears, as local communities across the circumpolar Arctic often do not support their physical capture. Further, non-invasive collection of genetic material can increase precision and decrease bias of population estimates, where physical capture is unsafe (high topography or small off-shore islands). Non-invasive sampling can also be conducted by local residents, who are often more knowledgeable regarding sea-ice travel; fostering collaborative conservation among scientists, government managers, and local communities. Hair snares have commonly been used in boreal systems to collect genetic samples from brown (*U. arctos*) and black (*U. americanus*) bears. These techniques however, have yet to be applied to polar bears or in the Arctic. Here we describe results from a pilot study to test a field method designed and implemented to sample wild polar bears. A prime opportunity exists in communities of Alaska, USA to test this technique for polar bears, as the remains of Bowhead whales, which are harvested by Natives act as an attractant for polar bears. The close proximity of our study site to the village of Barrow, allowed us to observe barbed wire fences on a daily basis, allowing us to test methodology (e.g., fence height, staking mechanisms, sampling frequency). Ultimately, we erected a single-strand barb wire fence around carcasses to collect hair samples for microsatellite genetic analysis. During fall 2010, >100 hair samples were collected from our site (photographic and visual observations suggest from at least 10 bears). Hair was considered to be a new sample if no other hair was collected within 6 barbs (approximate width of a polar bear). All uncollected hair was removed after each sampling period. The snare was checked at intervals set by observed patterns of bear use.

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### 49. Quantifying resistance of landscape characteristics to gene flow

We are developing a technique to estimate the effect of environmental characteristics on gene flow. To best maintain and restore connectivity within and among grizzly bear (*Ursus arctos*) populations, we want to understand how gene flow is affected by variables such as road density, number of buildings per square mile, highways, railroads, land cover type, and poor habitat. Current approaches for corridor planning usually rely on expert opinion. Current analytical techniques use coarse search techniques, but do not provide variance estimates. Our approach will provide estimates of the influence of each variable along with variance around our estimates.

Here we report on a simulation study examining the ability of our method to detect true resistance to gene flow under different scenarios. We evaluate the influence of landscape characteristics (random, slightly patchy, very patchy), relationship form (e.g. linear, quadratic, logistic), and the underlying assumption of how animals see their landscape (randomly= resistances based on circuit theory and all-knowing= least cost paths). We examine bias and precision of our estimates under all scenarios and provide recommendations about when our approach will be most appropriate.

Our next step will be to apply this technique to over 1500 genetic captures of 545 grizzly bears collected in 2004 across the ~ 8 million acre Northern Continental Divide Ecosystem. This technique will promote science-based corridor planning efforts for multiple species.

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## 50. Contemporary genetic substructure detected in American black bears in the absence of barriers to gene flow

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Historically, American black bears (*Ursus americanus*) were continuously distributed across North America. Today, they only show contiguous patterns of distribution in the northern part of the continent, whereas populations located in the South are geographically isolated, leading to concerns for their persistence. In Ontario (Canada), black bears are distributed over an extensive area (>1,700 km) free of obvious physiogeographic and anthropogenic barriers, with the exception of the southern periphery that is heavily influenced by human activities. This ecological context allows for a clear estimate of the level of decreased genetic variation of isolated black bear populations relative to their neighbouring, more intact, populations. We profiled 2839 individuals from 61 sampling sites at 15 microsatellite loci. A first analysis conducted with an aspatial Bayesian clustering method (STRUCTURE 2.3) assigned individuals into 3 main contemporary genetic clusters (Southeast, Northwest, Bruce Peninsula), which was similar to what was obtained with previous mtDNA analyses conducted on samples collected across Ontario. Each cluster (Southeast, Northwest, Bruce Peninsula) was further divided into 2, 2, and 3 subclusters, respectively, which was consistent with the results from a spatial Bayesian clustering method (TESS 2.3) that detected a total of 7 clusters. The geographically isolated Bruce Peninsula cluster was highly differentiated from the others ( $F_{ST} > 0.2$ ), while Northwest and Southeast shared a high level of gene flow ( $F_{ST} < 0.02$ ) despite the extensive

distance between them. Since black bear habitat in the Northwest region is largely homogenous and free of barriers, the differentiation detected within this cluster appears cryptic. We suggest that this substructure may reflect historical genetic patterns revealed by previous mtDNA analyses that found that black bears in this region are more closely related to the western phylogeographic continental subclade than to the eastern one.

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## 51. Viability of a small brown bear population at 70° North: Genetic analysis of the Pasvik-Inari-Pechenga population using 13 different STRs

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An important part in assessing the health status and long term viability of a population is the assessment of its genetic health. This is especially true for elusive species, like the brown bear, as other measures of viability are difficult to obtain. The brown bear population of the Pasvik-Inari-Pechenga (PIP) area at 70° North and 30° East is one of the Northern-most populations in the world and is assumed to be a healthy, reproducing population. The aim of this study was to evaluate the long-term viability of this population using genetic measures of population health based on DNA analysis using 13 different STRs. This was done by i) investigating genetic diversity and population structure, ii) estimating migration and gene flow between PIP and neighbouring populations and iii) estimating family structure and pedigree as well as exact population and effective population size. Samples for genetic analysis were obtained opportunistically by scat collection (2004-2010) and from hair traps placed systematically in a geographic grid system (2007 and 2008). The sampling area was restricted to 1300 km<sup>2</sup> and approximately 100 different individuals could be identified within this area in the time period. Systematic field observations were carried out in the same time period to supplement genetic data for investigation of family structure. Analysis is currently still ongoing and final results will be presented at the conference, where we also will draw conclusions about the viability of the PIP population and give implications for future management decisions.

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## 52. Genetic tracking of the endangered Asiatic black bears in the central mountains of Taiwan and implications for conservation

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Noninvasive genetic methods have been widely used to estimate elusive or abundance of threatened animals. The Formosan black bear (*Ursus thibetanus formosanus*), an endemic subspecies of Asiatic black bear (*U. thibetanus*) inhabiting Taiwan, is listed as a locally endangered species during past

decades. Although intensive ecological research programs have been conducted in Yushan National Park (YNP) since 1998, there have been no attempts to estimate the bear abundance. Due to the difficulty of collecting data for range-wide and small populations in remote and rugged terrain like our study area, our study aimed at estimating the size and genetic variation of the YNP population and providing guidelines for representative data sampling.

Using hair samples snared from baited traps with lures and fecal samples which were collected during February 2008-January 2009 in Daphan, microsatellite DNA analysis was applied to distinguish bear individuals. We analyzed 112 hair and 290 fecal samples, which yielded 62% and 54% of the successful DNA amplification rates, respectively. The genotyping based on 7 microsatellite primers for individual identification indicated 37 and 73 individuals, from hair and fecal samples, separately. Thus, a total of 100 different individuals were identified and the population estimation was further conducted and discussed. The average number of alleles per locus was 8.7, ranging from 5 to 19. The overall observed heterozygosity was 0.762, which was close to the expected heterozygosity (0.761). The overall  $F_{IS}$  value was 0.001. The result revealed the acceptable level of genetic diversity of the YNP population.

Among all bear individuals identified from genetic samples, 7% of them were only detected in the non-acorn season (October up to next January), and 90% were only detected in the acorn season. The mastig season of *Cyclobalanopsis glauca* in 2008 likely attracted a highly dense congregation of bears. Considering the bear movement pattern for seeking food and our result that all the effective samples collected in non-acorn season were hair samples, we suggested that hair traps should be technically feasible and suitable for areas with sparsely distributed populations. On the other hand, if a seasonal high-density benchmark like our study area can be identified, scat sampling tends to provide an appropriate representative of DNA sampling methods.

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## 53. Geographic and genetic boundaries of brown bear (*Ursus arctos*) population in the Caucasus

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The taxonomic status of brown bears in the Caucasus remains unclear. Several morphs or subspecies have been identified from the morphological (craniological) data, but the status of each of these subspecies has never been verified by molecular genetic methods. We analysed mitochondrial DNA sequences (control region) to reveal phylogenetic relationships and infer divergence time between brown bear subpopulations in the Caucasus. We estimated migration and gene flow from both mitochondrial DNA and microsatellite allele frequencies, and identified possible barriers to gene flow among the subpopulations. Our suggestion is that all Caucasian bears belong to the nominal subspecies of *Ursus arctos*. Our results revealed two genetically and geographically distinct maternal haplogroups: one from the Lesser Caucasus and the other one from the Greater Caucasus. The genetic divergence between these haplogroups dates as far back as the beginning of human colonization of the Caucasus. Our analysis of the least-cost distances between the subpopulations suggests humans as a major barrier to gene flow. The low genetic differentiation inferred from microsatellite allele frequencies indicates that gene flow between the two populations in the Caucasus is maintained through the movements of male brown bears. The Likhi Ridge that connects the Greater and Lesser Caucasus mountains is the most likely corridor for this migration.

## 54. Microsatellite population structure of Newfoundland black bears (*Ursus americanus hamiltoni*)

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We investigated population structure of black bears (*Ursus americanus* L.) from insular 25 Newfoundland using 12-locus microsatellite profiles from three broadly distributed areas 26 (Northern, Baie Verte, and Bonavista Peninsulas). Our goals were to revisit earlier findings of 27 low heterozygosity in Newfoundland and increase knowledge of intraspecific variability in black 28 bears, and make inferences about postglacial colonization and contemporary movements of 29 island black bears. Ninety-three individuals (42 males) were identified among 543 hair samples: 30 21 from Bonavista, 25 from Northern Peninsula, and 47 from Baie Verte. Genetic diversity is 31 relatively low ( $HE = 0.42$ ) and decreases from northwest to southeast. Small but significant 32 subpopulation differentiation revealed by  $F$ -statistics is greatest between Northern and Baie 33 Verte Peninsulas; it is lower and comparable in the remaining pairwise comparisons. We 34 hypothesize that postglacial colonization proceeded from the Northern Peninsula southeastward. 35 Bears migrated from the Northern Peninsula to Baie Verte at some more distant time in the past, 36 then diverged by genetic drift. More recently migration occurred from these two populations to 37 Bonavista, characterized by positive  $F_{IS}$  indicative of admixture. Tests of biased dispersal and 38 posterior probability of correct assignment to locality reveal contemporary movements of both 3409 males and females with historical dispersal attributable to males.

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## THEME: HABITAT SELECTION STUDIES

## 55. Grizzly bear wellsite use and associated avoidance behaviour in west-central Alberta

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In west-central Alberta, wellsites are common features in those areas where oil and gas development is prevalent; yet, little is known about how these sites affect grizzly bears. We examined grizzly bear selection and use of forest cover for ten individual bears within 500 m of wellsites between 2005 and 2010. Selection ratios were calculated in five equally large buffer isopleths. Eight of ten bears showed positive selection towards the zone containing the wellsite (WSZ). Important bear food growing on these sites is most likely the factor causing this pattern. Nonetheless, bears had generally higher selection ratios in the WSZ during nighttime compared to daytime, suggesting a temporal avoidance of human activity. The largest differences between day and night selection ratios appeared to generally occur in fall (September), especially for females. This coincides with the start of the big game hunting season in the area, and might be a response to a higher human activity around wellsites and access



roads during this time. Results of the analysis on forest cover, the WSZ selection ratio was shown to not be significantly correlated to proportion of forest, shrub or barren land in the WSZ. However, crown closure at bear GPS cluster locations for all available bear locations was not only lower in proximity to inactive wellsites compared to active wellsites, it was also varying depending on time of day. We conclude that some bears are readily attracted to wellsites but avoid human activity by making temporal adjustments in their behaviour, and by using cover as a compensation when in proximity to human activity. Positive selection for anthropogenic features easily accessible by humans increases the risk of bear-human conflicts, which may in turn lead to increased direct mortality for this threatened grizzly bear population.

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## 56. Impacts of a multi-use pathway on American black bears in Grand Teton National Park, Wyoming

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In 2007, Grand Teton National Park authorized construction of several paved, non-motorized pathways, situated close to existing roads. Construction of the first 13-km section was completed during 2008. The pathway resulted in direct loss of wildlife habitat, a new form of human use on the landscape, and a wider zone of human influence. We examined how these changes affected American black bear (*Ursus americanus*) movements, habitat use, activity, pathway/roadway crossings, and visibility to human park visitors. Twenty-nine bears, fitted with global positioning system (GPS) radio-collars, were monitored during 173 study periods: pre-pathway (2001-2007), construction (2008), and pathway (2009-2010). During 2009-2010, 6 trail counters were deployed to document human use of the pathway. Human use peaked during mid-summer (15 Jun-30 Aug) and during mid-day (1100-1600 hrs). Bears did not shift their home ranges to avoid the pathway, nor did they reduce their frequency of pathway/roadway crossings. Instead, bears altered the way they used the areas near the pathway. Across the study periods, bears showed greater selection for steep slopes and areas further from the pathway, and they were increasingly likely to cross the pathway/roadway corridor in areas providing vegetative cover. Near the pathway, bears decreased their activity by approximately 30% during midday, and increased their activity by about 10% during morning and evening. Proportion of roadway/pathway crossings occurring during nighttime hours also increased 17-40%. These behavioral changes allowed bears to utilize areas near the pathway, while reducing their encounter rates with humans. But, the observed shift of activities toward morning, evening, and nighttime hours may potentially increase the likelihood that bear-human encounters would occur during the low light conditions of dawn and dusk; increase the potential for black bear-grizzly bear encounters near the pathway; and increase the odds of vehicle collisions.

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## 57. Distribution and habitat use by sloth bear in Mount Abu wildlife sanctuary, Rajasthan, India

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We studied the distribution and habitat use by the sloth bear in Mount Abu wildlife sanctuary (MAWLS) from October 2009 to September 2010. The distribution pattern and habitat use of sloth bear were based on the direct sightings, number of den sites and from indirect evidences such as claw marks, foot prints, diggings and presence of scats were recorded and mapped. Through intensive surveys and by walking on 96 km along 32 transects in three consecutive seasons (winter, summer and monsoon).

In total, we had 161 direct sightings of sloth bears in 161 different locations in the sanctuary and 309 individuals including adult, sub-adult and young ones were seen. The sighting of single individual was 43%, two individuals were 25% and three individuals were 29% and four was 3%. So far we have identified 39 den sites in 23 places across the sanctuary area, out of which 25 dens were actively used by bears and rest 14 were used occasionally. These dens were located in different habitats; out of 49 dens, 33% (n=13) were in the moist deciduous forest, 21% (n=8) in dry deciduous forests. The data on indirect evidences showed varying use of these available habitats and landuse categories by sloth bear. Along the transects, there were total of 465 indirect evidences which included 105 scats, 242 digging signs, 50 claw marks and 68 pugmarks. The sign encounter rate (#/km) of sloth bear based on transects was 4.84. Outside transects, 368 bear indirect evidences were recorded while carrying out intensive surveys. Most of these evidences were found in dry deciduous forest (31.4%), followed by grassland (20.2%), bamboo forest (19.5%) and moist deciduous forest (17.7%). Based on direct sighting and indirect evidences, sloth bears were found distributed throughout MAWLS and they were differentially using various available habitats.

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## 58. Effect of patch size on occupancy and habitat selection by sloth bear (*Melursus ursinus*) at multiple scales in semi-arid habitat region, India

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Different habitat features can limit animal population at different spatial scales. We presented here effect of habitat patch size on occupancy and habitat selection by sloth bear (*Melursus ursinus*) in semi-arid habitat at two spatial scales (cell size): core area (1 km<sup>2</sup>), and home range (16 km<sup>2</sup>). Our goal were to identify important habitats characteristics for conservation at each spatial scale (cell size) using environmental variables. We used camera traps and indirect sign to monitor the sloth bear population. Results from a total 21436 camera trap days distributed across 9 habitat patches (ranging in size from 2 km<sup>2</sup> to 90 km<sup>2</sup>), were used for estimating the demographic and ecological parameters (Litter size, breeding period, activity period). As expected, across all scales, sloth bear occupancy was consistently and strongly correlated with patch size ( $P=0.016$ ) but not other features. Patch size affected the occupancy and activity of sloth bear. Sloth bear were strictly nocturnal in forested area  $\geq 20$  km<sup>2</sup>, whereas their foraging activity switched to a cathemeral pattern. Sloth bear sign were not detected in patch size  $< 4$  km<sup>2</sup>, and as estimate from a receiver operating characteristic curve, the ideal minimum patch size for patch occupancy was 20 km<sup>2</sup>. Our data support conclusions that diverse management schemes for sloth bear may be required to preserve relatively large contiguous forest patch.



## 59. Occupancy based abundance modeling, activity patterns and conflict status of Asiatic black bear in Khangchendzonga Biosphere Reserve, Sikkim, India

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We assessed the distribution, relative abundance, and activity patterns of Asiatic black bear in *Prek Chu* catchment (182 Km<sup>2</sup>) of Khangchendzonga Biosphere Reserve, Sikkim, India, from February 2008 to June 2010. We used trail sampling (n=22, 697.25 km effort), camera trapping (n=27, 7,364 trap nights), and habitat quantification (10m×10m plots, N=365) along trails and camera trap sites. Photo capture rates (#/100 trap days) of black bear were similar in temperate (1.19±0.69) and subalpine zones (0.93±0.49) during spring, whereas they were in temperate zone (0.94±0.42) only during autumn. Occupancy based modeling depicted elevation and vegetation cover of both temperate and subalpine zones (AIC wt 0.77) as important factors during spring, whereas it was the percentage of acorn producing trees in temperate zone as the most important factor for proportion of site utilization during autumn (AIC wt 0.86). Date/time stamp on the photographs (n= 54) showed 1800 h to 2000h as the peak activity period. We also assessed the status of black bear- human conflicts in Sikkim using semi-structured questionnaire surveys of villagers and secondary information during the period September to November 2009. There were 302 instances of conflicts [crop depredation (207), livestock depredation (75), attacks on human (20)] reported from 50 localities of the state. Number of conflict incidents were found positively correlated with altitude of village and negatively correlated with distance of village from dense forest ( $R^2 = 0.59$ ). Relative frequency of crop raiding, livestock killing and human attack were pooled and normalized to derive an index of bear damage for a village. Comparison between classifications of villages according to predicted potential index of bear conflict (derived from linear regression model) and observed index of damage showed 73 % appropriate prediction by the model. Local perceptions towards bears, compensation schemes, and mitigation measures for conflict areas will be discussed.

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## 60. Asiatic black bear home range and movement patterns in Dachigam Landscape, Kashmir, India

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We estimated home range and assessed movement patterns of Asiatic black bear (*Ursus thibetanus*) in Dachigam landscape, Kashmir, India, during 2009 – 2010 by tracking three bears, viz., 1 male (M1), 1 female + cub (F1) and 1 female (F2) using ground and Satellite telemetry. The 95% Kernel home range size for females were 8.34 km<sup>2</sup> (F1), and 68.98 km<sup>2</sup> (F2), whereas it was 107.23 km<sup>2</sup> for the male (M1). The male (M1) and a female (F2) made substantial use of habitats outside the protected areas of Dachigam landscape, but the female with cub (F1) had restricted her movements within Dachigam National Park. The home range of male (M1) overlapped with the females, 3.5% (3.3 km<sup>2</sup>) overlap with the female with cub (F1) and 9.7% (10.4 km<sup>2</sup>) overlap with the solitary female (F2). We quantified the effects of human development and topography on the tortuosity of black bear paths. Black bear path tortuosity increased near high human-use trails, near sites with food availability, and in rugged terrain. The average movement speed of individual black bear was calculated using Euclidian distance between successive locations. Bears moved faster in autumn and slower in spring. The bear movement was slower in areas with high availability of food species such as *Prunus sp.*, *Celtis*

*australis*, *Morus* sp., *Rubus* sp., *Juglans regia*, and *Quercus robur*, and faster through temperate grassland and temperate pine forest habitats. Black bears were observed to hibernate from mid December to late March with the period ranging from 40 to 77 days. Information on den characteristics, black bear behavior and management implications will be presented and discussed.

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## 61. Resource Selection by Asiatic black bear at multi-scales in Dachigam Landscape, Kashmir, India

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We assessed the resource selection by Asiatic black bear (*Ursus thibetanus*) at multi-scales in Dachigam Landscape, Kashmir, India from 2007 to 2010. Resource use by black bear was assessed in an intensive study area (90 km<sup>2</sup>) within Dachigam National Park, and an extensive study area (1,000 km<sup>2</sup>) comprising of protected areas, reserved forests, crop lands and villages. In each of the 23 grids (2 km x 2 km) of the intensive study area, we placed a camera trap and a hair snare station. A total of 13 transects/trails (c. 900 km effort), and 121 vegetation plots were sampled and monitored for assessing resource availability and use by bears based on visual encounters and sign surveys. We tracked bears (5 satellite collars, 1 VHF collar, 2 colour-coded collars & 5 ear-tagged) to assess resource use at the individual level. In the extensive study area, we carried out field and questionnaire surveys for bear-human interactions, and sampled 200 vegetation plots for black bear resource availability and use. Binary logistic regression for the resource use analysis indicated that parameters such as shrub density, canopy cover, elevation and ground cover were the major determining factors for resource use in the intensive study area. Collared bears used riverine and pine mixed forested habitats more than their availability, scrub and human habitations less than their availability, and the remaining habitats in proportion to availability. Black bear habitat use was determined by food availability in all seasons. The collared female with cub restricted itself to riverine and mixed forests within the natural bear habitats in the composite home range of collared bears. The other collared female and male used natural bear habitats and crop lands. The results on the resource use by marked individuals based on camera traps and non-invasive molecular tracking will be presented and discussed.

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## 62. Habitat segregation in brown bears: spatio-temporal patterns and their nutritional consequences

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Habitat segregation implies differential habitat use between sexes and reproductive classes of a species. It occurs in several brown bear populations, and infanticide has been suggested to be one of the major factors causing it. Our objective was to determine the occurrence of habitat segregation and its potential causes in a Scandinavian brown bear population, where infanticide previously has been

suggested as a major factor of cub mortality. We investigated spatio-temporal habitat selection of three reproductive classes of GPS-collared bears (i.e. adult males, adult females, and females with dependent offspring) during the mating and post-mating season in 2006 - 2010. We assessed the effects of habitat attributes (e.g. vegetation density, terrain ruggedness, distance to roads, etc.) on the habitat selection of the reproductive classes with resource selection functions. We mapped habitat use for each reproductive class per season and time of day, and quantified habitat segregation using the fuzzy kappa statistic with the Map Comparison Kit, a software tool to compare raster maps. We found significant differences in the preferences of the reproductive classes for vegetation density, terrain ruggedness and anthropogenic features such as roads, buildings and settlements. In general, females with dependent offspring selected less rugged terrain with lower vegetation density than the other two classes. They also avoided roads more than adult males, and stayed in relative closer proximity to houses. These differences were most pronounced during the mating season. Habitat segregation and different temporal patterns of space use were evident for all three reproductive classes during both the mating and post-mating season. To evaluate the causes of habitat segregation (e. g. predation risk avoidance hypothesis and sexual dimorph body size hypothesis) and their nutritional consequences we collected feces from 43 bears of known reproductive status on a weekly basis in 2010. We will use the nutritive content of feces as proxies for diet and habitat quality and complement our spatial analysis with this nutritional analysis. This will enable us to better understand causes and consequences of habitat segregation.

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## 63. Determinants of den site selection for grizzly bears in the boreal forest of Alberta, Canada

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Denning is widely viewed as an adaptation to cope with unfavourable environmental conditions primarily driven by a decrease in food availability and ambient temperatures. Because winter is a critical period, the choice and availability of an appropriate den site may be a crucial factor in the survival and reproductive success of hibernating individuals. To date, research looking at grizzly bear den site selection in North America has focused primarily on mountain habitats. Given that most grizzly bears in Alberta are found at lower elevations in the boreal forest, understanding den site selection at lower elevation is becoming increasingly important. Currently, even though the Alberta government recently updated the status of grizzly bears to “threatened”, land and forest management planning in grizzly bear habitat in Alberta does not include any mitigation measures to minimize possible impacts on grizzly bear denning habitat. To determine den site selection requirements in the boreal forest, we compared the characteristics of 20 grizzly bear den sites to random locations occurring within fall home ranges of the same individuals. Our results showed that grizzly bears selected steep slopes at all hierarchical levels to establish their den. Within home ranges, road densities did not affect the location of den sites but the presence of well sites and young cut blocks negatively affected the presence of dens in the surrounding area. Grizzly bears also selected locations with a greater occurrence of sweet-vetch (*Hedysarum spp.*) and buffalo berry (*Shepherdia canadensis*), a greater canopy cover, and a greater hiding cover than expected from random sampling. Given the rapid growth of industrial activities in Alberta, our findings may improve conservation efforts by providing guidelines to minimize land-use impacts on occupied and potential grizzly bear denning habitat.

## 64. Understanding the impacts of land-cover change: An analysis of Andean-bear habitat use

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Understanding how species are threatened by land-cover change is crucial for developing management interventions. This process is complex given scale dependencies and restrictions in data-collection methods and analytic tools. We evaluated habitat use of Andean bears (*Tremarctos ornatus*) across Sierra de Portuguesa to examine how sign-censuses, habitat characterizations and Resource Selection Functions (RSF) can be combined to assess the impacts of land conversion. We described habitat use based on three fundamental aspects: *Detection*, *Amount of Use* and *Activity*. We also carried out a preliminary evaluation of *Edge* and *Road* effects. Sign-censuses were undertaken on fixed-width transects (58) laid across *Primary Forest*, *Secondary Forest* and *Agriculture*, following a stratified-random sampling design across. We recorded 400 (13.79 signs/km) signs that indicated the presence of a resident Andean-bear population. The species was detected within three National Parks (NPs), providing the first scientific record for El Guache NP and refuting statements of its extinction in Terepaima NP. Individuals were confined to relicts of *Primary Forest* and they made minimal use of the surrounding matrix ( $X^2(2) = 12.67, p < 0.05$ ). Human activities and disturbance ( $-2LL = 137.04$ , Wald  $Z = 3.16, p < 0.05$ ), *Edge* and *Road* effects reduced habitat availability ( $X^2(1) = 18.61, p < 0.05$  and  $p = 0.04$ , Fisher's exact test, respectively). *Compression Effects* appeared to foster intensive resource exploitation and the absence of top-down regulation could be enhancing inter-specific competition ( $-2LL = 172.34$ , Wald  $Z = 3.16, p < 0.05$ ). Palm trees are an important food source for Andean bears across Sierra de Portuguesa and it could give the species an adaptive advantage. Agricultural expansions need to be halted, while restoration programs are encouraged to increase connectivity between remaining *Primary Forest* patches. Control of human activities within forested areas is also recommended, but political will is a limiting factor.

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## THEME: HUMAN BEAR CONFLICT / HUMAN DIMENSIONS

## 65. Human dimension of brown bear conservation in Lorestan, Western Iran

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The brown bear exist throughout Zagros Mountains in western Iran, particularly in Lorestan province. The animal has experienced a drastic decline in recent years, both in area of occupancy and number which the latter is mainly due to poaching. During 2010, we conducted a systematic questionnaire survey within local communities of four main regions located in northern half of the province. 59% of respondents encountered the bears, but no more than 15% were attacked by the animals. No lethal human casualties occurred in among respondents, but there were several reports of deaths across Lorestan. 37.5% of interviewed people lost livestock to the bears, mainly sheep with occasional cases

of goat and ostrich. 29% of interviewees spotted dead bears in the area, all killed by human which is nearly in accordance to 20% stated that they would kill the bear when they encounter it. Human-bear conflict is partially caused due to lack of knowledge among local people about this creature which has created some misunderstandings. Recommendations to reduce conflicts and conservation of bears are presented.

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## 66. Assessment of human-bear conflict in north Gujarat with special reference to bear habitat management

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Sloth bears are found widely in lowland forests of the Indian subcontinent. The information regarding where bear occur and the landscapes used by bears are very important to formulate conservation and management strategies for sloth bear. With the exception of productive efforts in north Gujarat to manage bear populations based on mostly anecdotal information, there is no population level management being implemented for bears in the region. We surveyed both the protected and unprotected forest patches in the bear habitats of north Gujarat using 5 x 5 km grid overlaid on land-use maps to determine sloth bear presence or absence. Interviews of local people, victims and others were conducted during the study period of three years. We assessed respondent's perceptions and attitudes towards sloth bears. On the bases of information collected in a pre formatted questionnaire we assessed the causes of conflicts, probable landscapes for conflicts and perception of locals towards the sloth bear. Bear attacks were found higher in the vicinity of villages around protected areas where water is a limiting factor. Out of all recorded cases, 34% attacks occurred during daytime. Cold season have significantly higher number of bear attack in the region. 87 % of the respondents said that presence of sloth bear is threat to man while in answering majority of the other questions the people were remain unsure. This unsure attitude reflects lack of awareness among local community. Effective management by keeping vigil on fire during summer, using preventive measures and adoptive law enforcement can be practiced. We also identified the landscapes where human-bear conflicts are acute, which can be manage or alter to minimize human-bear confrontation in the area. We suggested several measures of adoptive land use management that can enhance the possibility of human-bear coexistence in north Gujarat.

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## 67. Conflicts and conservation status of the Andean bear (*Tremarctos ornatus*) in an indigenous Aymara community in Lambate, South Yungas, La Paz - Bolivia

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The Andean Bear is the only bear species in South America and despite of being a charismatic and endemic species, it suffers from habitat destruction and in some areas conflicts with indigenous communities because of the damage to their crops and cattle causing its illegal hunt. That reduces and threatens the bear populations close to human settlements. Studies in Bolivia related to bear ecology, conflicts with humans and other conservation issues are scarce; this lack of information highlights the

importance of this study, which focuses on the local perception, possible conflicts and the conservation status of the Andean Bear in the Lambate Region, La Paz-Bolivia Four "Aymara" Indigenous communities were selected, where unstructured interviews with a variety of members of each community were conducted; inquiring about information on their perception on the bear such as; Distribution; Frequented sites; possible conflicts; damage to crops; possible competition with cattle; if there were hunting activities; type of habitat and other information; Also, I inquired about tradition and myths of the area related to this species and other details the hunter would like to provide. Although these communities live close to bear population, their knowledge on the ecology of the Andean Bear was limited, and many misconceptions and a negative image on the species was a frequent perception; And several conflicts with locals related to damage to their crops and cattle conflicts were documented but not evidence presented. At the conclusion of the project I organized workshops to present the results to the community; these activities were complemented with environmental education, and diffusion related to conservation. The information obtained contributed to the local communities to maintain their traditions, but more important to create their own regulations related to possible Bear conflicts, increasing the involvement in conservation with a better understanding of the Jukumari.

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## 68. Implemented methods for bear damage prevention in the South East area of the Romanian Carpathians mountains - Best practices

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On the framework of two LIFE+ Nature projects, implemented in South East part of the Romanian Carpathians, we implemented with demonstrative purposes bear damage preventive measures, with the goal of encouraging the local farmers to use best available methods for farms protection. During the last three years, on the LIFE projects area, we select the most vulnerable points with the highest frequency of bear damage. After three years, the results are favorable, and the public opinion changed in the positive direction. Each year we used 30 electric fences, as single method, or combined with new experienced methods as repellent substances, or sound deterrents. From these methods the most effective on the long term was the electric fences. In the cases in which the farmers accept to use these systems the level of damage decreases by 80-90%. The other two methods implemented separately were successful, only on short period (1-2 weeks). The poster presents the each step made in the project, starting with damage analysis, selection of the method, monitoring of the method results and the overall results regarding damage level and social acceptance.

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## 69. Human- Baluchistan black bear conflicts in the Bahr-e Aseman area, South- East Iran

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Habitat of Baluchistan black bear (*Ursus thibetanus gedrosianus*) in mountainous areas of southeastern part of Iran has been substantially altered by increases in human populations and associated habitat changes. This is the first survey on Baluchistan black bear and human conflicts through a semi-structured questionnaire conducted from spring to fall 2009 in Dehbakri and Bahr-e Aseman regions. Baluchistan black bears in Bahr-e Asman Mountain live in forest and semi-forested mountain habitats (900–3200 m) in Jiroft County, Kerman Province. Among 412 villages, approximately 55% are without permanent residents and mostly with one to five families, 37 villages with more conflicts between bear and human were selected. In these selected villages 40 people (85% male and 15% female); ranging between 20 to 80 years old with direct contact with bears were interviewed. The interview was conducted to address the aggressive feature of the bear, the seasons of human and bear encounters and respondents attitudes towards the bear. Results showed during recent years, nine human injuries and one death occurred and the last bear poaching happened 12 years ago. About 19.75% said bears attack livestock, 8.75% said they attack humans, 65% called it a shy creature, while 7.50% knew nothing about this feature. 20% of encounters occurred in spring, 41.60% in summer, 15% in fall, 0% in winter and 23.40% could not remember the time. Of all respondents, 79% considered it as a noble animal and think bear attacks on humans are rare. The main source of antagonism against bear resulted from the damages they caused to agricultural crops and livestock. In addition, we documented that most of the interviewers tend to use bear gall bladder and recorded some cases of bear poaching for traditional medicine.

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## 70. Factors influencing the human-sloth bear conflict in Nilagiri, Orissa, India

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Sloth bear populations in India are vulnerable to decline because of rapid habitat loss, degradation and fragmentation and conflicts with humans. This study was conducted in Nilagiri, which comes under Balasore Forest Division in state of Orissa; to understand the nature and extent of human-sloth bear conflict and suggest appropriate mitigatory measures to reduce the level of conflict. Human population in this division is 1, 80, 000 (51% males and 49% females) and spread in 78 villages. Information on human casualties by sloth bear was collected from the forest department's records and verified through interaction with affected people. A total of 141 sloth bear attacks between June 2002 and October 2009 were recorded which caused 6 human deaths. Maximum human casualties occurred during monsoon season (n=65, 46%), followed by summer (n=41, 29%) and then winter (n=35, 25%). Most of the victims were in the age group of 26-55 years (72%). Male people were attacked more (n=110) than females (n=31). Incidences of sloth bear attacks occurred in the vicinity of forests, along the road, kitchen gardens, and crop fields. Competition for common food resource utilization (forest produces), livestock grazing in bear habitats, habitat destruction and raiding agricultural crops by sloth bear were important factors behind the human-sloth bear conflicts. Sustainable use of forest produce, restoration of sloth bear habitats and education and awareness among people for natural history of sloth bear are important to reduce the human-sloth bear conflict. Recommendations have been made for conservation and management of problematic sloth bear populations thriving in this part of the country.

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## 71. Recent data on brown bear damage on agriculture in N.E. and Central Pindos Range - Greece

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Brown bears (*Ursus arctos*) as opportunistic omnivores and occasional predators show a relatively low proportion of animal origin food items in their diet (circa 10-15% in Greece, of which only a part corresponds to livestock) (Mertzanis1991, Mertzanis1994, Mertzanis et. al. 1996, Paralykidis 2005, Giannakopoulos et al. 2006). This feeding behaviour relies upon synergic parameters such as: food availability, food concentration and accessibility, the three main characteristics of domesticated livestock and crop as human-related bear food resources. Bear damage on livestock, crop and apiculture in Greece was systematically investigated in the frame of two ongoing LIFE-Nature projects (duration 2009-2013) in two adjacent geographic areas within permanent bear range located in northern and southern Pindos mountain range. We used standardized semi-structured type questionnaires through direct interviews conducted from October 2009 to January 2010 on a sample of seventy five (75) livestock raisers. Moreover we evaluated 780 official compensation claims from 2007 to 2009 in the two study areas. Bear damage on livestock was low compared to livestock availability (~1% of the recorded livestock) and affected mainly cattle: 32.4% of total damage claims. Overall damage intensity was also low: circa 65% of the recorded cases and 77.65% (from official claims) of bear attacks, correspond to losses from 1 to 4 small sized livestock. Crop damages were recorded mainly in corn, wheat fields and vineyards, while damages to apiaries were important averaging 25% of the total damage claims. Damages are characterized by a culminating period from May to October marked by two yearly picks in June-July and October. Overall total compensation cost paid to farmers reaches 110,000€ yearly. The most effective long-term solution to minimize bear-human conflict related to bear damage on livestock and crop seems to be the use of preventive measures such as: electric fencing and livestock guarding dogs.

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## 72. A case of brown bear poisoning with carbofuran in Croatia

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On 19 April 2010 in the hunting ground adjacent to the Velebit Nature Park near natural water hole the jackal (*Canis aureus*) corpse was found, and the day later a dead European brown bear at a distance of 200 m was found as well (coordinates: X 5545067, Y 4906858). There were no visible injuries on bear carcass; only on the front legs the vomited watery content was found. On three spots near the water found were baits consisting of meat, bones, and dark blue compact granules, which indicated that they were placed after the last rain, or a maximum of 6 days ago. On April 21 the veterinarian from the Faculty of Veterinary Medicine Zagreb accompanied by police officers visited the site. Veterinarian performed autopsy and found a bloating corpse, moderate autolysis and congestion of organs. Liver and kidney tissue samples and entire ligated stomach were taken. All baits found along the water hole were collected too. Frozen tissue samples and baits were sent to the police forensic laboratory. In the stomach a small amount of liquid bluish content was found. By the gas chromatography-mass spectrometry (GC-MS) the presence of carbofuran (insecticide from the



carbamate group) was determined in the stomach content and in the baits. In kidney and liver tissue the presence of the carbofuran was proven by high performance liquid chromatography-mass spectrometry (LC-MS) with mean measured concentrations of 2.695 and 12.650 ppm, respectively. Based on the findings of high concentrations of carbofuran in liver and kidney tissue, a short distance between baits along the water hole and the place where the corpse was found, with certainty we claim the animal was per acutely poisoned by this compound. This is the first proven record of a poisoned bear in Croatia, although the bait was probably not targeted to bears.

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## 73. Behavioral change of a male Japanese black bear in a mast failure year in Ashio-Nikko Mts., central Japan

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In the autumn of 2010, there was a mast failure, and the Japanese black bear intrusion into human-habitation was broadly occurred through Honshu Island. In the results, 2,304 bears were nuisance-killed, and 118 people were injured by bears, including 4 deaths (as of 31 October 2010). This was 3<sup>rd</sup> mass-intrusion that happened in the decade (In 2004: 109 people were injured by bears (including 2 deaths), and 2,021 bears were killed; in 2006: 145 people were injured by bears (including 3 deaths), and 4,340 bears were killed), because of the bears traveled an extensive range in search of food resources.

The extensive mast failure especially for *Fagus crenata*, *F. japonica*, and *Quercus crispula* was also confirmed in our study area in 2010, in the Nikko National Park, central part of Honshu Island. One of the GPS collared bears (MB69: male, age at 17 yr. old as of 2010) has moved out from his usual home range in the end of August, and after some traveling, he has found a private fish farm where was surrounded electric fence in the foothills, but it was being un-worked due to the current leaking. When MB69 has habituated to the farm, he has drastically changed his daily activity pattern from diurnal to nocturnal. Finally, MB69 has nuisance-killed on 28 August. Although other GPS tracked bears have unusually lost their body weight in the autumn than the summer, MB69 has increased his body weight for 24kg (BW=105kg) within a month than the summer.

This was suggested that mast failures could be one of the significant reasons for the conflicts, but it is also as a result of a decline in bear avoidance effort in the foot hills due to aging of local residents. Thus, there is a new generation of bears that do not fear people.

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## 74. Bears and airports: determining effective mitigation measures for reducing bear encounters at the Prince George Regional Airport

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Where airports occur within the range of bears, large animal strikes have been reported and are of an obvious and serious threat to air safety. A review of 34 airports (14 small, 16 regional and 8 national) in western Canada indicated that 58% of responding airports reported that large mammals such as bears are commonly observed on airport properties. Seventeen of the 35 airports reported using fencing as a countermeasure to reduce airport conflicts, but only one used electric fencing. Efforts to exclude bears and mitigate such occurrences appear to be largely unpublished. At the Prince George Regional Airport, Prince George, British Columbia, Canada (53°53'02.78"N, 122°40'30.97"W) we are conducting research on the ecology of bears that utilize the airport property and attempting to determine appropriate mitigation strategies to reduce/eliminate visits and collision risk. Control Tower sighting data collected between March 2004 and September 2007 indicate that bears are a small fraction of animals sighted at the airport, but do occur and apart from moose are the largest animal occurring inside (airside) of the airport fencing. Wildlife camera data, animal sightings, scats, tracks and tree scarring recorded on the airport property between 2007 and 2009 all indicate the presence of several resident bears. Most sightings are reported from a south-facing slope on the airport property referred to as "Bear Hill". Observational data suggests that early greening vegetation appears to be the major attractant. Although eliminating attractants has been recommended for reducing bear activities at airports, attempting to accomplish this on a large heterogeneous property can be difficult and time consuming. Our review of the literature indicates that electric fencing is likely the most effective means of excluding bears from areas such as highways, dumps and wildlife shelters. We continue to explore other options for excluding bears from the airport, but plan to recommend the installation and testing of electric fencing to the airport authority to reduce the odds of encounters between bears and aircraft at the Prince George Regional Airport.

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## 75. Livestock depredation and crop damage by Himalayan brown bear in Kugti wildlife sanctuary, Himachal Pradesh, India

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We studied the human-brown bear conflict in Kugti wildlife sanctuary, Himachal Pradesh during 2001 to 2009. Information on livestock killings and agricultural crop damage by brown bears was collected from the records of the forest department and by interviewing the villagers and shepherds. Assessment of crop damage was done using 'control' and 'uncontrolled' plots in crop fields.

Brown bear showed aggression a few times to shepherds and villagers in different dhars (pastures). Amongst livestock, sheep and goat were mainly preyed upon by brown bear, whereas there were only a few killings of cow, bulls and mules. About 187 migratory graziers visited 22 grazing pastures (dhars) in the sanctuary from April to October every year, and 1,23,823 livestock were taken to 12 dhars, the intensive study area. Brown bear preyed upon 4,764 livestock in these 12 dhars. There was no correlation between number of livestock visiting these dhars and extent of depredation. Maximum livestock depredation occurred in Ghaiula dhar (12.5%), followed by Nanaun (11.2%), Bharali Kinnaur (10.9%), Andhrali kinnaur (10.3%) and Bhiad (9.4%) dhars. Livestock depredation varied in different months; maximum depredation on sheep and goat occurred during August (37.3%), followed by September (19%), July (16.9%), June (10.5%), May (8.3%) and October (8%). Brown bears attacks were maximum (58.6%) during 2001-0400h, followed by 17.2% during 0801-1600h, 13.4% during 1601-2000h and 10.8% during 1401-0800h. Maximum number of livestock depredation occurred during mid-night. Agricultural and horticultural crop damage by brown bear

was found to be quite visible. Damage to barley, wheat and maize crops was 19.5% to 34.75%. Maize and wheat plants were trampled more than eaten. Among horticultural crops, brown bears were found to damage apple, peach and jamu (5-22%). Recommendations for mitigation of human-bear conflicts and conservation of brown bear have been made.

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## 76. Movement pattern of Himalayan brown bear (*Ursus arctos isabellinus*) and interface with human in Kargil, Ladakh

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We investigated the movement of the Himalayan brown bear on the basis of food availability. We also recorded the brown bear-human conflicts in the Mulbek and Rangdum Valleys of Kargil, Ladakh.

Movement of brown bear was investigated on the basis of food availability, i.e. domestic livestock and plant material. In Rangdum Valley, we observed that during the snow free period (April to September) livestock depredation by brown bear was reported when shepherds grazed their livestock in the higher meadows. September onwards, livestock moved down to the villages and this resulted in the brown bear shifting to feed on the *Rosa species* in the adjacent Mulbek Valley, where *Rosa species* is abundant as compared to the Rangdum Valley. We found upto 80% seeds of *Rosa species* in the scats of brown bear. It seems that movement pattern of brown bear in these two valleys was governed by the availability of food sources.

Habitat use by brown bear was assessed through indirect evidence. The use of aspect was found to be significantly different ( $\chi^2= 7.97$ ,  $P < 0.05$ ) and Northern ( $n=8$ ) slope was used more than Southern ( $n=2$ ) and Eastern ( $n=1$ ) slopes. It may be because of the rich palatable food sources on the Northern Slope. All the 11 signs of evidence were found along the river and streams with a gentle slope.

Livestock depredation by brown bear was observed in three villages situated in these two valleys. They reported loss of 14 sheep and goat by brown bear during 2009.

As of now locals are withstanding the losses of the livestock and there is no serious conflict. But realizing the retaliatory killing of brown bear in other parts of Kargil, it is necessary to take appropriate steps for long term survival of brown bear in Kargil, Ladakh.

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## 77. Analyses of the Romanian south eastern Carpathians human bear conflicts based on bear damages, human opinion, bear hunting

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In 2010, a Life+ Nature Project started in the South-Eastern range of the Romanian Carpathians, the area which hosts the biggest Romanian brown bear population (4,3 bears/10 km<sup>2</sup>). In the study area

the bear habitats are overlapping with human inhabited areas, agriculture lands, farms and other human activities. The goal of one of the project's activities was to analyze the distribution of the bear damages in the whole area, studying the context of each case. In parallel we assessed the knowledge and attitude of local the people regarding bears and human-bear coexistence. We analyzed also the relation between the hunting activity and it's results on damage prevention and public opinion. The results showed a weak correlation between the damage densities in different areas and the knowledge of local people about bears and a very divergent opinion on the cause of different damages and responsible parties. Most of the survey's elements considered that hunters are responsible for bear damages and that the hunting activity has no effect on the prevention. During the following two years of the LIFE+ project, the results will be used to improve the human bear conflict management on the Romanian South-Eastern Carpathians. The results indicates the area in which preventive measures should be implemented, identifying also the best solution for damage prevention, offering also a new approach for human bear coexistence in the project area.

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## 78. The bear in the Indian imagination: impact upon status, conservation and conflict mitigation

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India is home to four species of bears- Himalayan Brown Bear (*Ursus arctos*), Asiatic Black Bear (*Ursus thibetanus*), Sloth Bear (*Melursus ursinus*) and Sun Bear (*Helarctos malayanus*). Unfortunately, today, all these four bear species are considered vulnerable in the country, owing to a multitude of factors.

This paper argues that a key, though not so obvious, factor contributing to the decline is the attitude and perception of people towards bears. The place of the bear in the Indian popular imagination (and in policy circles) not only script the relationship between human and bears but also ascribes a 'status' to the bear and determines the priority accorded to its conservation in India in the present day.

The paper presents the case that the bear in the Indian sub-continent has not enjoyed the status enjoyed by more 'charismatic' wildlife species such as the tiger, elephant and lion. Traditional belief systems or cosmologies have overlooked it too. Bear hunting has never commanded 'elitist' status either in medieval India or colonial India and consequently, no conscious efforts were made to preserve bears in game reserves.

The low priority accorded to bear conservation in India is reflected in the fact that the available guestimates of bear populations in the wild in India still remain debatable. So are the numbers of bears being poached year after year for its various organs used in medicines, meat or performance on the streets.

The Government of India as well as various national and international organizations are taking initiatives of bear conservation in India. However, for the conservation of the four species we would perhaps need participation at a much larger scale; embedding the bear and the imperative of its conservation in the imagination of both rural and urban India.

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## 79. Interpreting recent increase of brown bear conflicts in Hokkaido, Japan

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The number of nuisance brown bear (*Ursus arctos*) kills has been on the increasing trend since the spring hunt abolishment in 1990. Brown bear kills in the early summer (June and July) and the late summer (August and September) have been increasing significantly ( $P < 0.05$ ) for the last 20 years. On the other hand, there is no increasing trend in the number of kills during the spring (from January through May) and the autumn (November and December) despite annual fluctuations. These differences in trend of bear kills among the seasons would be related to bear food habits. A rapid increase in bear kills during the late summer, which is coincided with remarkable seasons of agricultural damage caused by bear, suggests that an increasing number of bears are learning to feed on agricultural crops. We also analyzed the relationship between the bear kill statistics and the monitoring results of beech (*Fagus crenata*) nuts and oak (*Quercus crispula*) acorn production in the Oshima Peninsula, southwestern Hokkaido. The bear kills during the autumn is negatively correlated with the mast production; such influence of mast production would also be applicable to other parts of Hokkaido. Although it is necessary to implement actions for bear damage prevention to reduce problem bears, farmers and/or agricultural administration bodies are not concerned with the effective damage prevention measures such as electric fencing or crop field edge mowing. Increasing conflict occurrence will lead to an increasing bear kills which can become a threat to population sustenance. It is necessary to establish integrated measures to prevent bears from learning the taste of human food items especially agricultural crops and to concurrently implement a system to recognize problem individuals and then take proper control actions against them.

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## 80. Relocating Grizzly Bears in Alberta: Measuring Success

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Translocation, the capture and moving of a bear, is one wildlife management technique that is used across North America to remove bears from conflict situations. In Alberta, Canada, records of grizzly bear translocations have been maintained since 1974, yet there has been no formal evaluation of these management actions. The Recovery Plan for Grizzly Bears in Alberta (2008-2013) identifies that lack of knowledge on the survival of translocated bears is a limitation for the effective conservation of the species. While survival rates are of immediate concern from a recovery standpoint, the definition of relocation “success” may have different meanings within wildlife management agencies and to the public. There has also been limited effort to evaluate the possible influence of gender, age, conflict type, or release location on the success of translocations.

We reviewed trends in the number, spatial distribution, translocation distance, time of year, and demographic characteristics of grizzly bears translocated in Alberta, Canada in two time periods. In the first time period from 1974-2004 bears were captured, ear tagged and relocated with no directed follow-up on outcome. In the second period, starting in 2004-2010, we fitted 23 bears initially with ARGOS radiocollars and, later, with GPS/ARGOS collars to monitor movements and survival post-release, and to compare the behaviour and fates of bears that were released in different areas of the province. Finally, we compared the movement rates and habitat use patterns of translocated bears to

those of resident bears to test whether translocated bears used of areas with higher mortality risk which contributed to lower survival rates.

A total of 279 grizzly bear translocations were recorded from 1974 to the start of our collar based monitoring program, and most bears were removed from Bear Management Areas (BMAs) in the southern portion of the province, and released in northern BMAs. No follow up was conducted and the fates of most of the bears are unknown. Number of bears translocated/year increased throughout the first period. Adult males were the most common type of bears moved, which may reflect the provincial decision matrix used to determine the circumstances under which bears should be translocated. Of the 23 bears radio-collared during the second period, the success of translocated bears fitted with radiocollars was low. Our data indicate that female bears were more likely to survive than male bears, and that bears released into the northernmost BMA in Alberta have a low probability of success. We discuss the value of identifying measures of success, implications of the translocation management technique for grizzly bear recovery, and provide recommendations to improve the grizzly bear translocation program in Alberta.

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## 81. Urban black bear ecology: fluctuating synanthropy and its implications for management

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Urbanization continues to be a major force shaping our world. It correspondingly drives the need to examine the synanthropy of wildlife, particularly their dependency on anthropogenic resources and the subsequent changes in space-use, diel activity, and population dynamics. A common assumption is that some species are either synanthropic or not, where the degree of synanthropy and its seasonal and annual variation are rarely considered. Understanding such patterns is especially important to better manage urban wildlife and resolve human-wildlife conflicts. Using GPS data collected from 2005-2009 on black bears (*Ursus americanus*) in Aspen, Colorado, USA, we examined current hypotheses about bear synanthropy suggesting that bears will have smaller home ranges and shift to nocturnal activity to utilize human food sources, and that habituation of bears leads to irreversible synanthropy. We examine these hypotheses using activity and location data collected at 5- and 30-min intervals, respectively. We modeled bears' home range of and diel activity patterns as a function of individual covariates (e.g., gender, age, reproductive status) and environmental covariates (e.g., season, quality of natural food production, human development). Bears incorporated more developed areas in their home ranges and became more nocturnal in years of natural food production failure, but returned to "wildlands" and "normal" activity patterns in subsequent good natural food production years. The variability in the degree of synanthropy indicated behavioral plasticity by bears and did not support assumptions of full synanthropy (i.e., irreversible habituation). We discuss implications for conflict management and to the bear population, especially in years of natural food failures, when there is potential for similar cities to serve as population sinks.

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## 82. The carrot or the stick? Evaluation of education and enforcement as management tools for urban human-bear conflicts



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Human-wildlife conflicts have increased worldwide with the increase in human development into wildlife habitats. Traditional management tools targeting wildlife are often ineffective, short-term solutions, and there is a growing recognition among wildlife managers that longer-term solutions should include altering human behaviors. Public education and enforcement of wildlife-related laws are two primary methods implemented to change human behaviors, but little research has been conducted to evaluate the success of these tools for conflict management. In this study we experimentally tested three education and enforcement tools to determine their effectiveness at altering human behavior and reducing the availability of anthropogenic attractants to black bears (*Ursus americanus*) in Aspen, Colorado, USA. Specifically, we evaluated on-site education using information at dumpsters, neighborhood-wide Bear Aware educational campaign, and elevated enforcement at two levels (daily patrolling with or without written notices for violations) in reducing the availability of garbage to bears. Responses, i.e., changes in human behavior, included the following direct measures: violations of local wildlife ordinances, garbage availability, and change to a bear-resistance refuse container. We found little support for education, as implemented, or enforcement in the form of daily patrolling in changing human behavior, but found more support for proactive enforcement, i.e., dispensing warning notices. More broadly, we demonstrated the value of gathering evidence before and after implementing management actions, and the dangers of measuring responses using human-bear conflicts in the absence of ecological knowledge. We recommend development of more effective educational methods, application of proactive enforcement, and continued evaluation of tools by directly measuring change in human behavior. We provide empirical evidence adding to the conservation managers' toolbox, informing policy makers, and promoting solutions to human-bear conflicts.

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## 83. Brown bear (*Ursus arctos*) food habits in human dominated landscapes of Slovenia: Is supplemental feeding an effective way to reduce conflicts?

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Slovenia is one of the few European countries where bears in high density coexist with people in a multi-use landscape. During the last century, supplemental feeding of brown bears has been widely used in Slovenia for various purposes. Nowadays it is also applied as a conflict mitigation measure aimed to keep the bears away from the human settlements and to decrease depredation of small cattle. Food provided at numerous supplementary feeding sites consisted mostly of maize and carrion, until feeding with carrion was banned in 2004 due to E. U. legislation. Anecdotal evidence suggests that this might be the reason for increased number of sheep depredations in the following years.

We analyzed 428 bear scats, collected in the period 1993-1995, when feeding with carrion was still allowed. The analysis showed that supplemental foods formed a minor part of bears' diet; mean estimated volume of carrion was  $\approx 7\%$  including carrion obtained by scavenging on ungulate carcasses. Results indicate that bears feed mainly on insects, despite the large amounts of animal carrion provided at the feeding stations. Data from the stomach content collected from removed bears showed that carrion and maize were used more frequently by adult and sub-adult males and during the winter and spring. Our telemetry studies show that feeding stations in Slovenia probably do not

deter bears from approaching human settlements. Moreover, monitoring of bears at feeding stations suggests that bears have no preference in feeding on carrion compared to feeding on maize. Feeding with carrion is a very expensive measure and current legislation requires culled bears fed on carrion to be burned, because of danger to transfer diseases like BSE to humans. Based on the results from this study we do not recommend supplemental feeding to be re-established for bear-people conflict prevention.

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## 84. Body condition, sex and age of problem bears - considering social status and food availability

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Wildlife managers and the general public consider brown bears appearing close to people to be a nuisance and a threat to human property and safety. The prevailing paradigm is that such “problem” bears use areas close to people in search of food.

Females with dependent young, and especially subadult bears, seem to occur close to people more often than adult males and females without cubs. We tested whether problem bears are either subdominant (i.e. subadult) or individuals vulnerable to intra-specific predation (i.e. subadults, females with cubs-of-the-year) and therefore occur near human settlements to avoid competition with dominant adult bears. We compared the body condition index (BCI) of bears killed as nuisance individuals with that of bears killed during regular hunting in populations in northern (Sweden and Finland) and southern (Slovenia and Croatia) Europe. Subadult bears were more often killed as problem bears than adult bears in all populations. We found no correlation between occurrences of problem-bears and mean annual BCI of bears shot during regular hunting in northern Europe, however, the BCI of problem bears was significantly lower than that of bears killed during regular hunting in southern Europe. Problem bears occurred most often during periods of high intraspecific aggression (i.e. the mating season in May-July) in northern and southern Europe. We found a significant correlation between the number of problem bears and poor environmental conditions only in southern populations.

The BCI of bears shot in self-defence was not significantly different from bears killed during regular hunting in the Swedish population. However adult bears were more often shot in self-defence than subadults, perhaps because adults have a generally shorter flight distance than younger bears. Our results suggest that the occurrence of problem bears may be caused by a combination of factors involving intraspecific social behavior as well as food availability.

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## 85. Behavior of supplementally fed black bears in Eagles Nest township, Minnesota

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During 1996-2010, we studied black bear (*Ursus americanus*) behavior in Eagles Nest Township, MN, a 36-square-mile area where people had hand-fed bears at up to a dozen supplementary feeding sites since 1961. Hand-feeding replaced misconceptions with experience and created a general community-wide willingness to coexist. Today, about 24 habituated, food-conditioned, resident black bears (plus transients) coexist with 300+ households. People hike without fear. Despite hunting, habituated bears survived to as old as 26¾ years. Each year, we radio-collar 8-17 of the resident bears (without using tranquilizers) and monitor them visually and electronically. None was dependent on supplemental food. All foraged, scent-marked, dispersed, defended territories, investigated den sites, mated, raised cubs, and explored distant areas as appropriate for age and sex. Visits to supplemental feeding sites depended upon wild food scarcity, with individuals going weeks, months, or years between visits. DNR records for 1996-2005 showed 2 nuisance complaints from the study area versus 10,027 complaints and 3 attacks statewide. Detailed data from the local Wildlife Management District showed that the two complaints from the study area were for an adolescent looking in a window and a bear eating bird seed, while 23 (17%) of 138 complaints from elsewhere in the District involved break-ins. Bears preferred wild foods and supplementary feeding sites over small amounts of food at residences elsewhere, so people who reduced attractants seldom saw bears. Habituation was generally specific to locations and situations. When a habituated, food-conditioned adolescent male dispersed, he avoided human habitation while being monitored for over a year to a point 83 miles from his birthplace. The data indicate that black bear nuisance behavior is linked more closely to hunger than to habituation or food-conditioning and that diversionary feeding merits study as a potential tool to reduce human/bear conflict.

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## 86. Effectiveness of environmental-education programmes for Andean-bear conservation

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Environmental education has been a fundamental tool to promote community awareness towards the plight of endangered species. Following a systematic-review approach, we evaluated the effectiveness of such intervention to develop positive attitudes towards the Andean bear (*Tremarctos ornatus*). Environmental education was only described as a strategy to mitigate threats towards the species by documents developed in Venezuela (50%), Ecuador (46%) and Colombia (4%). A variety of tools was used to communicate the educational message among the programmes carried out, but publicity was the most popular mean applied. The general public and children of local schools were usually the focus of these initiatives. Most programs highlighted the natural value of the species as main message. Only 3 of the 28 documents reviewed evaluated the effectiveness of education programs, and they used before and after assessments of knowledge and/or attitudes towards the Andean bear for these evaluations. We found that the knowledge about the species only improved significantly among communities with no human-bear conflict (Effect size = 0.49). No changes in attitudes were detected in conflict areas (Effect size = 0), probably due to the lack of continuity of the programmes implemented, and the use of a message that was not adapted to the needs of rural people. Future programmes need to be designed with medium to long-term perspective, tackling the particularities of each community-species interaction. Additionally, they should be accompanied by a set of practical solutions to tackle the problems identified within the local population. Existing initiatives must be

evaluated and adapted to ensure not only the promotion of knowledge about Andean bears, but also changes in attitudes and behaviours that translate in reductions of the threats towards the species.

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## 87. The habitat used by habituated bears compared to bears with natural behaviour. A case study in Brasov - Prahova Valley - Romania

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The habituated bears represents the bears used with human presence, that live in wilderness, but have deviated feed comportment, thus they don't feed from nature, but use the source of food easy accessible from urban garbage area.

The issue of habituated bears presents more important aspects: assuring and maintaining the security of population from vicinity of zones frequented by bears with deviated comportment, the conservation of natural eco-ethological characteristics of *Ursus arctos* species and the urban garbage management.

For diminishing the phenomena of habituated bears we studied several measures: the wildlife game management (capturing and relocation of 69 exemplars of bears, between 2006-2009), the garbage management and the campaign of public awareness and education in the studied area.

In order to stand out the differences between the comportment of different types of bears, we studied 15 bears with various social structure: 6 bears from areas with strong antropisation, 5 bears with moderate antropic pressure and 4 exemplars with minimum human influence, coming from natural habitats.

The studied animals have been captured and tranquilized, we took biological samples and biometric measures and they have released with GPS-GSM collars.

By monitoring the habituated bears from Brasov area we acquired important information about deviated comportment of those bears and this study generated a set of measures regarding the recovery of natural feeding comportment of this kind of bears.

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## 88. Asiatic black bear human conflicts in Nepal

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We assessed the Asiatic Black Bear (*Ursus thibetanus*) - Human Conflicts in two protected areas (Langtang National Park and Dhorpatan Hunting Reserve) of Nepal. We had adopted the semi-structured questionnaire surveys as major method for the causes of conflicts and their mitigations.

We interviewed 182 local villagers in LNP and 190 in DHR to collect information on cropping patterns and livestock holdings, bear attacks on humans, livestock depredation, causes for conflicts, and the current practices of local villagers in reducing conflicts.

Local villagers (n=182) reported that black bear accounted for 11.63% of the total loss to agricultural crops by wildlife and such loss due to black bear was higher in buffer zones (<2,000m) of Langtang National Park. They reported that 18 agricultural/horticultural crops were raided by black bears, with maize, paddy and millet suffering substantial losses. The black bear generally loss the crops from mid July to December. During the period 2000 to 2006, six cases of bear attacks on people have been reported. Black bear accounted for about 10% of the total livestock depredations due to wild carnivores.

During the period 2001 to 2007, four cases of bear attacks on people have been reported. The overall loss (21.29%) of agricultural crops in 2006, the black bear was responsible for (6.53%) and in 2007, out of total loss (22.45%) the black bear was responsible for (8.33%) in DHR. The total number of livestock loss due to large carnivores from 2006 to 2007 was accounted to 69 livestock. Out of them, black bear was responsible to 4.65% in 2006 and 5.0% in 2007. The black bear preferred 4 agricultural crops whole 8 species of wild food species.

Bear crop raiding behaviour and preferences for plant parts varied between crop types. Local villagers currently practice many indigenous methods to reduce crop raiding by black bear, of which guarding crops during nights and chasing away bears by making noises were found to be most effective.

To reduce crop raiding by black bear and other wild herbivores in the high conflict zones, we propose community based night vigilance by a group of local villagers on a rotational basis. Other measures such as habitat improvement in the buffer zones and changes in cropping patterns are proposed for reduction in crop raiding by black bear.

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## 89. Polar Bear Alert Program, Manitoba Conservation

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Polar bears that are found in the region of Churchill, Manitoba are part of the Western Hudson Bay subpopulation. Encounters between humans and polar bears did happen periodically in the past; however, they did not become prominent until the latter part of the 1960s when a noticeable increase of polar bears was noted. Due to public demands for safety, a control program was set up for the protection of residents of Churchill and immediate area. During the early years of the program it became evident that a high number of polar bears were being destroyed in protection of life and property. A review of the control program was completed in the early 1980s. Subsequent to that review, changes were made that clearly incorporated protective measures for polar bears. It was at this time that the control program of polar bears in Churchill transformed into what is currently known as the Polar Bear Alert Program. The operational delivery of the program has resulted in significant decreases in the number of human–bear encounters, and has minimized the number of polar bears destroyed as problem bears each season. The combination of physiological stress of longer ice free periods and cumulative impacts of increased permanent removal could have irreversible effects on the conservation of polar bears of Western Hudson Bay. It is for these reasons that the Polar Bear Alert program addresses the primary objective of public safety, while still providing for the welfare of polar bears in and around the Churchill area.

## 90. Do public complaints reflect trends in human-bear conflict?

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Minimizing conflicts with humans is a necessary component of the management of American black bears (*Ursus americanus*) across most of their range. The number of complaints about conflicts with black bears is commonly used to infer trends in the actual frequency or severity of human–bear conflict, and even trends in bear population size. However, the number of complaints received by management agencies is a function of both the frequency of and the reporting rate for conflicts, and the reporting rate may change over time. We tested for effects of food availability, numbers of bears harvested, and management regime changes on 3 measures of human–bear conflict: (1) public complaints, (2) traps set to capture bears involved in conflicts, and (3) bears killed in defense of property in Parry Sound, Ontario, Canada, 1992–2008. Human population size and the total annual bear harvest did not change during the study. All measures of human–bear conflict were inversely related to food availability. Complaints increased following a controversial change in management (cancellation of the spring hunting season), but numbers of traps set and bears killed were not affected. Reproductive synchrony was apparent in harvest-at-age data, and may have influenced annual harvests and the frequency of human–bear conflict. We suggest that an increase in the reporting rate for human–bear interactions was largely responsible for the increase in complaints following the spring hunt cancellation. Trends in the frequency and severity of human–bear conflict should not be inferred from trends in complaint data unless factors that could affect the reporting rate for conflicts are accounted for.

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## 91. Behavioural responses of grizzly bear to human activity along a salmon stream in the northern Yukon

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Wildlife-based ecotourism has rapidly increased in popularity, especially when featuring large mammals in their natural environment. Researchers have questioned the sustainability of wildlife-based ecotourism because it may compromise the survival and reproduction of focal animals. I investigated the potential spatio-temporal effects of bear viewers on grizzly bears at a proposed bear viewing site along the Fishing Branch River, Yukon. I directly observed bear behaviour in an area of high human use during periods with and without bear viewers. Through direct observations and video recordings, I was able to observe bear behaviour in an area of high and low human activity within the viewing area. Spatial river use of grizzly bears was largely explained by habituation status. Bears consumed 24 % less salmon when viewers were present, posing serious energetic consequences if spatio-temporal compensation does not occur. Dominance status had no measurable effect on bears' fishing behaviour presumably because abundant salmon and few conspecifics minimized resource-driven competition. However, dominance status could influence feeding behaviour in years with reduced salmon abundance, which would compound viewer-induced reductions in fish consumption. I recommend further investigation into potential spatio-temporal compensatory behaviours of grizzly bears along the Fishing Branch River.

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## 92. Can the use of a bear-proof waste collection system be cost-effective?

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Located in the Rocky Mountains west of Calgary, Alberta and east of Banff National Park, the Town of Canmore has experienced steady population growth over the years. As the town grew into the surrounding wilderness, animal access became more problematic.

Prohibiting garbage set-out before 5am did not address the fact that a portion of Canmore's population consists of non-permanent residents who may not be in the town on collection day. It was found that bears adjusted their forage pattern to match the availability of curbside bags/carts.

In 1996 the municipality made the decision to convert to a semi-automated bear-proof container system that effectively minimized bear/human conflicts at approximately 70% of the cost of bagged collection. Therefore, it was shown that an animal proof waste system can be cost effective.

In spite of the savings to be generated, residents of the town had some concerns about the new system. It was a new and different solution that had to work in all applications from residential to commercial.

Through an open and public process, the Waste Management Committee was able to alleviate the concerns of the citizens of Canmore. The containers would be conveniently located to allow 24 hour accessibility.

It was decided to proceed with a gradual implementation with the entire community having access to the new system by May of 1999. The system continues to be a success and is now used for both residential and commercial waste and recyclables.

In addition to achieving the primary goal of *virtually eliminating waste related bear/ human incidents*, the system has also proven to be flexible, aesthetic, accessible, and cost-effective by providing the *Lowest Total Cost of Ownership*.

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## THEME: NEW TECHNIQUES FOR BEAR STUDIES

## 93. Inducing conditioned taste aversions in American black bears using a detectable emetic

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Across taxa animals have evolved the ability to detect and avoid potentially poisonous foods when they experience illness following ingestion. Scientists have taken advantage of this phenomenon to induce Conditioned Taste Aversions (CTA) in wildlife to non-poisonous foods to mitigate human-wildlife conflict. One of the most important criteria needed to induce a taste aversion is that the emetic must be undetectable, or the animal will continue to consume untreated attractants and only avoid treated attractants. A promising emetic is thiabendazole, a reportedly undetectable veterinary drug which has been used with varying success to deter animals, including black bears (*Ursus americanus*), from consuming specific attractants. We tested thiabendazole in Whistler, BC, Canada on nine different black bears baited to simulated conflict sites monitored by remote cameras in 2008 and 2009. Baits were known to cause human-bear conflict and were difficult to secure from bears, and included: restaurant grease, paintballs, and apples. None of the seven bears we treated in 2008 rejected any of the baits in post-treatment. We present evidence that bears distinguished thiabendazole-treated baits from untreated baits; however, by using a new protocol, we successfully induced taste aversions to apples in four bears in 2009. Demonstrating that at least some bears can detect thiabendazole in some baits could explain the variability of success of inducing CTA using thiabendazole in the scientific literature. Furthermore, our treatment protocol in 2009 offers possibilities of using other detectable emetics to induce taste aversions in wildlife to mitigate human-wildlife conflict.

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## 94. Use of dogs to detect denning grizzly and polar bears on Alaska's North Slope: a proof of concept

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Off-road activities associated with oil and gas development on Alaska's North Slope are scheduled during winter when the frozen substrate and snow cover reduce surface damage and minimize construction cost. However, these activities could disturb denning grizzly and polar bears. To mitigate disturbance, agencies require buffers around active dens. This requirement presumes that methods to detect the true den location are available. Forward Looking Infra-red (FLIR) imaging has been variably successful in detecting polar bear dens. There has been no systematic evaluation of FLIR on grizzly bear dens. A method to detect dens and to ground-truth the FLIR imagery was needed. We investigated the efficacy of dogs to locate dens of radio-marked grizzly bears, and putative dens of polar bears initially detected by FLIR. The first trial on polar bears used Labrador Retrievers. Subsequently, we used Karelian Bear Dogs. Our objectives for polar bears were to detect bears that had not been detected by FLIR, and to confirm putative dens that had been detected. Our objective for grizzly bears was to evaluate the precision of the dogs' alerts on known bear dens. We visited the dens the following summer and calculated the precision of the alert.

The dogs successfully located 24 of 25 grizzly bear dens with precision of 5-30m. Dogs confirmed the location of 10 polar bears detected by FLIR (true positives), determined that 4 locations were false positives, found 3 dens the FLIR missed (false negatives), and did not find one den confirmed later (false negative). The dogs also "cleared" >200 km of polar bear denning habitat where industry activities were planned. Dogs located grizzly and polar bear dens under 2-6m of dense snow, and in weather conditions beyond the operational limits of existing FLIR imagers. Operational advantages and constraints of using dogs will be presented

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## 95. Tracking brown bears in Greece: a simple non-invasive method for individual identification

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Sound management and conservation of endangered animal species requires accurate population size estimates at the individual level. In order to objectively identify individual brown bears (*Ursus arctos*) in Greece, a non-invasive method was developed based on their tracks. For these reasons, we measured 16 linear dimensions on 91 forefoot tracks from seven radio-collared and four non-collared brown bears in the Northern Pindos range. Multiple regression analyses and decision trees were subsequently applied to define those linear dimensions that would successfully distinguish individual bears and the minimum number of tracks per individual required to achieve accuracy. The best classification tree model, in terms of classification errors and size, included three linear dimensions: "track width", "nail-lowest point of digit III" and "width of digit I" with 93.75% of accuracy. The performance of the model was considered as "almost perfect", with a Cohen's kappa scoring as high as 0.9251. In addition, seven different forefoot tracks per individual were required for accurate identification. The validity of the method was further supported by significant correlations between "track width" and selected body measurements of radio-collared bears. The accuracy and relatively simple application of the proposed method renders it favorable for establishing a non-invasive inventory of brown bears.

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## 96. Occupancy modeling of Asiatic black bears using sign surveys

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To protect rare or endangered species, biologists need efficient and effective methods of collecting ecological data that can be applied to model the species occurrence across their range. One of the objectives of this study was to develop and test methods of Asiatic black bear sign surveying to determine feeding ecology, habitat use, and landscape scale occupancy. Occupancy modeling was used to determine the effects of basic ecological covariates on Asiatic black bears in and adjacent to Tangjiahe Nature Reserve, Sichuan Province, China.

We recorded data on bear sign detected during repeated fixed-width strip transect (100m x 20m) surveys performed within a larger 1km<sup>2</sup> grid (N=42) design. The resulting data were used to analyze detection/non-detection with recorded covariates of Asiatic black bears. We further analyzed the data using each transect as a site and the age of the bear sign (0-1 year old, 1-2 years old, 2+ years old) detected as a surrogate for three "repeat" sampling occasions. We then re-analyzed the resulting data of detection/non-detection with recorded covariates.

The resulting grid level detection probability (SE) was 0.675 (0.0421) and the occupancy rate was 0.8095 (SE 0.821). Based on AIC values for the grid analysis the top model had a constant probability of detection [p(.)] and the level of protection category as the covariate. The analysis of the transect data yielded a detection probability (SE) of 0.4845 (0.0338) and an occupancy rate (SE) of 0.6605 (0.0455). The AIC values of the survey analysis's best fitting model again had a constant probability of

detection [p(.)] and the protection category covariate. The results thus demonstrate the resilience and adaptability of the Asiatic black bear to a wide array of ecological scenarios while highlighting the difficulties associated with human impacts.

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## 97. An innovative barbed wire hair snagging method of documenting black bear roadway crossings

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With growing bear populations and ever-increasing roadway projects, biologist and transportation departments must understand Ursine road use to effectively mitigate vehicular and bear interactions. Our research focuses on black bear and red wolf crossings along a two-lane highway (NC-64) in Dare County, North Carolina. Along this ~12 mile-stretch of highway through the Alligator River National Wildlife Refuge, black bears constitute the majority of vehicular wildlife incidents.

This study will determine the most effective locations for wildlife underpasses as part of a proposed 4-lane expansion project on NC-64.

Barbed wire hair snagging has proven very effective and extremely precise in documenting bear road crossings. We strung two strands of barbed wire along the entire length of roadway using the existing guard rail system. We GPS located, collected, and genetically identified each hair sample collected, allowing us to document the number of crossings and the bears performing the crossings. We have collected 1,021 hair samples from 443 crossing events. Distribution of hair collection sites along the road highlights obvious “hotspots” of bear crossing events where underpasses might be most effective, but it also illustrates the Ursine ability to cross the road nearly anywhere, and, thus the difficulty in placing a 100% effective crossing structure. This barbed wire method provides both precision and nearly complete coverage of bear use along the roadway, allowing minimal maintenance but efficient monitoring and collection for long-term roadway studies.

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## 98. Differentiating grizzly bear movement behaviors using consecutive vector clustering techniques

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Distinguishing between movement types is essential to understanding grizzly bear spatial movement patterns. Both large amounts of fine-scale GPS radiotelemetry data and sequential data structure approaches are required. Our approach employed time series graphs to differentiate between different types of movement behaviors and allow for the quantification and assessment of consecutive vector data. For each grizzly bear ( $n = 5$ ), vector movement paths were generated using consecutive GPS telemetry locations taken at 20 min intervals. Consecutive movement vectors were then segmented into a series of homogeneous slow movement and fast movement clusters (i.e. periods of local stationarity). Mean comparisons were used to test for quantitative differences between movement rate



(km/h), mean turning angle (deg), month, time of day, and duration of movement cluster. We further explored spatial movement patterns by generating kernel density surfaces where foraging or travel movement clusters were weighted according to the duration (number of segments) of the cluster. Finally, resulting individual grizzly bear movement patterns were compared to underlying landscape properties.

At fine spatiotemporal scales, individual movement patterns were highly variable in both form and function, ranging from straight-lined fast movements to highly concentrated slow movement clusters. Results emphasized that slow movement clusters occurred more often and for longer periods of time when compared to fast travel segments. Both slow and fast movements were increased for June and September indicating seasonal differences within vector structures. While some movement-habitat relationships were identified, results were highly individual by bear. Overall models tended to respond the best for bears residing in the mountains over bears residing in the foothills. Results further emphasized the importance of separating vector-based movements according to type (slow versus fast) for future modeling efforts.

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## 99. An attempt to analyze food habits of Japanese black bear using GPS collar with a video camera

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Japanese black bear (*Ursus thibetanus japonicus*) spend most of life in the steep and dense forest. It makes difficult to observe directly. Therefore food habits study had to rely on the findings of feeding sign and scat analysis. However these methods include some problems such as difference of finding rate of traces and differences of digestibility each from food components. Then, GPS technologies have provides vast quantities of detailed location data. However GPS position often cannot understand without additional field data.

To address these issues, we developed a new collar attached a GPS unit and a rugged video camera which can record images in 1080p HD quality and fitted for Japanese black bear (adult female) which were captured on Oct. 2010. In consideration for influence of chemical immobilization, video record period was set to start after the next day. Three days later timed collar release was worked and retrieve this collar.

In this way, we succeeded in taking 4h 46min videos. These images consist of 59% active behavior such as foraging, searching for food, and locomotion between patches and 41% resting behaviors such as sleeping. In addition the clear images make it possible to identify the level of species eaten by bear and how to eating. The foraging behavior could be identified as following patterns.

1. Eating the crimson glory vine (*Vitis coignetiae*) fruits while standing on the ground or climbing tree
2. Eating the dropped fruits of crimson glory vine on the ground.
3. Eating the herbs mostly thistle species (*Cirsium* sp.) while stopping.
4. Eating the herbs while walking.

These information were impossible to reveal relying solely on GPS location data. Using the video analysis also can determine the feeding spend time of each food item. These suggested that we are possible to understand the detail habitat use of bears.

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## THEME: PHYSIOLOGY OF BEARS

### 100. Validation and application of hair cortisol concentration as a biomarker of long-term stress in free-ranging polar bears

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Human-caused environmental change can negatively affect the sustainability of wild populations. For example, ecological change in the Arctic as a result of climatic warming has been advanced as a significant threat to the conservation of polar bears. We propose that estimating long-term physiological stress in individual bears is a key metric linking ecological change with impaired population performance. Hair cortisol concentration (HCC) has recently been established as a biomarker of long-term stress in humans and domestic animals. We developed and validated a technique to measure HCC in hair collected from live-captured polar bears. Samples were washed, dried and ground to a fine powder from which 25 mg samples were extracted for 24 hours with methanol. The supernatant was dried under nitrogen gas at 38 °C, reconstituted in phosphate buffer (12 hours at 4°C) and analyzed by enzyme-linked immunosorbent assay (ELISA). The technique was precise and accurate in a minimum of 25 guard hairs. We measured HCC (range 0.16-2.26 pg/mg) in 191 polar bears captured in Hudson and James Bay from 2007-09. HCC did not vary with hair type or body region and was not influenced by age or sex. It was inversely associated with body mass and directly associated with Julian day of capture. Adult females with dependant offspring had higher HCC than other reproductive classes. HCC values in offspring were directly associated with that of their mother. We are presently evaluating relationships between HCC, blood serum-based measures of long-term stress, growth and body size of individual polar bears, duration of annual sea-ice coverage, and measures of population performance in the Southern Hudson Bay subpopulation. We suggest that broad application of this technique may provide insight into potential linkages between the environment and population performance in a variety of wild species facing ecological change.

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### 101. Changes in expression of hepatic genes involved in energy metabolism during the hibernation period in Japanese black bears

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Hibernating bears consume only stored body fat as the energy source. Body fat is broken down to glycerol and fatty acid which are main resources for the production of glucose and ketone bodies in the liver, respectively, suggesting that the liver has an important role in the energy production for other peripheral organs during the hibernation period. In the present study, we examined the expression of hepatic genes involved in energy metabolism during hibernation in captive Japanese black bears (*Ursus thibetanus japonicus*). Pieces of liver tissue were sampled by needle biopsy in active (early summer and autumn) and hibernation phases (Jan : early phase, Mar : late phase), and differences of hepatic mRNA expression between the two phases were detected by using quantitative real-time PCR. During hibernation, the mRNA expression of enzymes involved in gluconeogenesis (e.g., pyruvate carboxylase, phosphoenolpyruvate carboxykinase) were up-regulated whereas glycolysis-related ones (e.g., liver pyruvate kinase) were down-regulated. Increased expression of enzymes in the fatty acid beta-oxidation pathway (e.g., carnitine palmitoyl transferase 1) and in ketogenesis (e.g., 3-hydroxy-3-methylglutaryl-CoA synthase 2) were detected in the early phase of hibernation (Jan) but these changes were not remarkable in the late phase (May). In contrast, lipogenesis-related enzymes (e.g., acetyl-CoA carboxylase) were down-regulated during the hibernation period. These results suggest that glucose production from glycerol and fatty acid utilization in the liver are activated during the hibernation period, by changing the transcription patterns of key enzymes involved in energy metabolism. In addition, it is suggested that hepatic gene expression patterns during hibernation is not maintained static, but changes as hibernation progresses.

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## 102. Fluctuation in the serum C, N, and O stable isotope compositions in captive Asiatic black bears during hibernation

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Many ursids, including Asiatic black bears, have a metabolic process for hibernation, the details of which are poorly understood. We determined the C, N, and O stable isotope compositions of serum samples from Asiatic black bears (*Ursus thibetanus*) in Japan in order to obtain basic data for studying metabolic processes during hibernation. Serum samples were collected from six captive female bears once a month from September 1999 to February 2000. All of the bears started to hibernate at the end of November, and gave birth in the beginning of February.

The serum  $\delta^{15}\text{N}$  values increased from November to January. The serum  $\delta^{13}\text{C}$  values increased slowly from October to January, while the serum  $\delta^{18}\text{O}$  values decreased from November to January. The change in  $\delta^{13}\text{C}$  started one month before the onset of hibernation, while the changes in  $\delta^{15}\text{N}$  and  $\delta^{18}\text{O}$  started just at the onset of hibernation.

These findings suggested a relationship between the changes in the serum  $\delta^{13}\text{C}$ ,  $\delta^{15}\text{N}$ , and  $\delta^{18}\text{O}$  levels and the metabolism of hibernation. The increases in  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  might be related to urea recycling, and to self-digestion because of fasting during hibernation. The decrease in  $\delta^{18}\text{O}$  might be the result of isotopic fractionation during the process of lipolysis. Further studies are needed to obtain conclusive results.

## 103. Distribution of feeding-related and reproductive neuroendocrine peptides in the grizzly bear brain

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Feeding and reproduction represent two physiologically vital functions, yet their regulation is highly species, sex, and season specific. The North American Brown bear is regarded as an extremely efficient hyper generalist with respect to feeding. Reproduction in female brown bears is highly seasonally restricted, characterized by induced (reflex) ovulation and embryonic diapause. Males exhibit a clear seasonal pattern of steroid production and testes size. To begin to appreciate the brain's role in the regulation of these two linked processes, brain tissues from both male and female grizzly bears were obtained during late hibernation (n=4) or mid-summer (July, n=4) and were processed using immunocytochemistry for the following hormones or receptors: 1) Feeding – orexin (ORX), melanin-concentrating hormone (MCH), neuropeptide Y (NPY) and phosphorylated STAT3 (pSTAT3); 2) Reproduction – gonadotropin-releasing hormone (GnRH), estrogen receptor. The results reveal an extensive distribution of ORX in the hypothalamus with a similar distribution of MCH neurons but with much lower density, especially of fibers. NPY was also distributed widely in a non-overlapping pattern to ORX and MCH. Preliminary observation of pSTAT3 in the basal hypothalamus of hibernating, but not active, bears suggests a state of leptin sensitivity during hibernation but leptin resistance during the active season. These observations may help explain the relatively large appetite and desire to accumulate fat during the active portion of the year and the need to monitor lipid stores during hibernation. GnRH neurons in both sexes were distributed widely from the forebrain to the hypothalamus, but with a clear concentration in the basal hypothalamus. The distribution of GnRH neurons in the bear resembles that of another reflex ovulator, the ferret (*Carnivora*), but differs from that of other reflex ovulators, the rabbit (*Lagomorpha*) and musk shrew (*Soricomorpha*). The distribution of estrogen receptors in both sexes was greatest in the preoptic area and basal hypothalamus.

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## 104. Low cortisol facilitates photic entrainment in grizzly bears

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Plasma glucocorticoids, such as cortisol, vary annually in many seasonal animals, including the North American Brown bear. Elevated cortisol levels observed during hibernation in both captive and wild grizzlies have been proposed to serve as a permissive agent for energy mobilization from lipid reserves. Additionally, cortisol has been recently implicated in affecting entrainment of the circadian system to photic cues in rodents. Specifically, inhibiting cortisol hastens recovery from a phase shift of the light:dark cycle (jet-lag paradigm). The objective of this study was to determine if low cortisol, as observed during the active season, facilitates entrainment of locomotor activity following a 5 h phase advance of the light cycle applied during both the active and inactive (hibernation) periods in bears. Prior to the 5 h phase advance of 'lights-on' time, adult and subadult grizzly bears were

exposed to ambient photoperiod during the active season (July-Aug. 2010; n=5) and a 6L:18D photoperiod during the inactive season (Dec.-Jan. 2009-10; n=5). During both seasons bears received saline or betamethasone (to suppress cortisol; 0.2 mg/kg active, 0.1mg/kg inactive, i.m.) in a crossover design. Activity was monitored using both video recording and Actical devices (Minimitter, Phillips Respironics, Bend, OR). During both the active and hibernation periods, betamethasone reduced the variability of activity onsets compared to saline ( $P < 0.04$ ), supporting the hypothesis that low cortisol levels facilitate photic entrainment. Thus, the elevated plasma cortisol observed in the grizzly bear during hibernation may reflect an adaptation to reduce responsiveness to light cues during the denning period and to maximize energy conservation.

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## 105. Mercury in tissues of brown bears in Croatia: age, sex and seasonal differences

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Continuous monitoring of mercury (Hg) levels as toxic metal in wild animals is important because of its ability to accumulate in biological tissues thereby impairing animal's health. Also, such monitoring gives us valuable information about Hg levels in the surrounding environment. Without notable anthropogenic Hg source in studied regions of Croatia, measured levels in largely herbivorous bears would reflect plant Hg levels transferred from soil (natural sources) or Hg transported via the atmosphere (remote anthropogenic sources). In contrast to large number of reports about contaminants in largely carnivorous polar bears, Hg levels in European brown bear were studied only sporadically, lacking any information about Croatian population.

In this study, Hg levels were measured in muscle, liver and kidney cortex of 90 brown bears (*Ursus arctos*) hunted during spring and fall 2009, and spring 2010 according to "The Brown Bear Management Plan for Croatia". Age-, sex- and season-related differences were examined. Distribution of Hg across tissues was as follows (median; range): muscle (0.002; 0.00008-0.018 µg/g wet mass), liver (0.034; 0.0001-0.198 µg/g), kidney (0.238; 0.016-1.20 µg/g). Correlation between different tissues was statistically significant (Spearman  $R = 0.5-0.7$ ,  $p < 0.001$ ). Age had no influence on Hg in any bear tissue, but sex and season (in males) showed such trend. Females had higher Hg in all three tissues compared to males ( $p < 0.05$ ) but showed no differences between spring and fall Hg content. Males shot in fall had higher Hg in liver ( $p < 0.001$ ) and kidney ( $p < 0.001$ ) than the ones shot in spring. As prevalent route of Hg intake in bear is ingestion, seasonal cycles in food availability are reflected on differences in food consumption. Factors causing sex-differences in Hg levels could be hormones, reproductive state, and size variations. Found Hg levels are in the same range as previously reported for brown bear population from western Carpathians.

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## 106. Estimating the success rate of ovulation and early litter loss rate in the Japanese black bear (*Ursus thibetanus japonicus*) by examining the ovaries and uteri

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Examination of anatomical structures in female genital organs is a possible option for studying reproductive status of bears when carcasses are available. We examined the ovaries and uteri from Japanese black bears (*Ursus thibetanus japonicus*) killed as nuisances during 2001-2009 for placental scar (PS), corpus luteum (CL) and corpus albicans (CA). The presence of PSs in all of the 18 females with offspring suggests that a female without PSs captured by November has no parturition history in the year of capture. From the fact that offspring were cubs in all the 9 litters whose age was estimated, we inferred that most females wean their offspring before the mating season in the second year postpartum. The age-specific proportion and the monthly proportion of females bearing CLs showed that the age at first ovulation is 4 years, and that most females have finished ovulation before August. The change in the detectability of CAs over time indicates that, when CAs are detected in females with PSs, a parturition had taken place in the year of capture. Based on these findings, we estimated the success rate of ovulation (SRO) and early litter loss rate (ELLR) to be 0.93 (62/67) and 0.27 (6/22), respectively. We calculated SRO as the proportion of females bearing CLs among females  $\geq 4$  years old, without PSs and captured from August to November. These restrictions were derived considering age at first ovulation, offspring status and mating season. We defined ELLR as the rate of whole litter loss before the mating season in the year of parturition, and calculated it as the proportion of females bearing CLs among females with PSs and CAs.

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## 107. Morphology of the sperm cells in the spectacled bear (*Tremarctos ornatus*)

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Little scientific literature has been published concerning the various aspects of the reproductive physiology on Spectacled bear *Tremarctos ornatus*. Given the current threatened status of the species, assisted reproduction could be considered as a potential alternative for conservation; however, artificial insemination and sperm cryopreservation techniques require the biological, physiological and morphological knowledge and characterization of the gametes. Under that scope, this communication describes the Spectacled bear sperm cell morphology. Semen samples of two clinically healthy adult males from the Huachipa Zoological Park, Lima - Peru were evaluated. The samples were collected using electroejaculation technique under anesthesia. After the basic semen evaluation, samples were fixed and colored using diff quick stain and then the morphological characteristics were analyzed ( $x \pm \text{SEM}$ ): normal spermatozoa ( $88.75 \pm 0.85$ ), head defects ( $4.25 \pm 0.63$ ), only head ( $2.00 \pm 0.71$ ), tail defects ( $1.75 \pm 0.48$ ), and cytoplasmic droplet ( $3.25 \pm 0.63$ ). For morphometric value assessment, sperm cells were analyzed using an automatic semen analysis computer system (CASA). The parameters evaluated were: spermatozoa length ( $5.34 \pm 0.15\mu\text{m}$ ), width ( $3.72 \pm 0.05\mu\text{m}$ ), area of the head ( $16.84 \pm 0.55\mu\text{m}^2$ ) and perimeter of the head ( $16.07 \pm 0.32\mu\text{m}$ ), acrosome percentage ( $67.70 \pm 3.38\%$ ) and midpiece width ( $0.95 \pm 0.09\mu\text{m}$ ) and midpiece area ( $2.06 \pm 0.22\mu\text{m}^2$ ). Results found



concur with the reported in the literature for other bear species. Considering that this is the first study that presents a record of sperm cell dimensions (morphometric values) of *T. ornatus*, this is an important contribution for the general knowledge of spectacled bear reproduction.

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## THEME: POPULATION ECOLOGY OF BEARS

### 108. Contrasting past and current numbers of spawning cutthroat trout and grizzly bears using tributary streams of Yellowstone Lake, Yellowstone National Park

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Historically, spawning cutthroat trout (*Oncorhynchus clarki*) were found in great numbers within tributary streams of Yellowstone Lake and were a highly digestible source of energy for Yellowstone grizzly bears (*Ursus arctos*). Early research (1985–1987) documented fishing activity by bears on 36 of the 124 tributary streams of Yellowstone Lake, but in recent decades, availability of cutthroat trout has declined due to the introduction of non-native lake trout (*Salvelinus namaycush*), drought, and whirling disease (*Myxobolus cerebralis*). As a result, peak numbers of fish, duration of spawning runs, and indices of bear use in streams of the West Thumb region of Yellowstone Lake had declined by 1997–2000, with a minimum of 74 grizzly bears visiting 25 sampled tributary streams. We initiated a 3-year study in 2007 to assess whether numbers of spawning fish and bear use of stream corridors had changed. We sampled 35 of 36 streams historically fished by bears, employing 48 hair snare sites positioned streamside. We estimated numbers of grizzly bears visiting streams by analyzing individual DNA encounter histories within a Jolly-Seber model (POPAN). When compared to 1997–2000 numbers, our results show a decrease in peak numbers of spawning fish/run and total number of surveyed stream-years containing spawning fish. We estimate that 48 (95% CI = 42–56) male and 23 (95% CI = 21–27) female grizzly bears visited the vicinity of historically fished tributary streams. Although bear use of fish has declined, bear numbers have remained relatively stable in the Lake basin. Therefore, bear density does not appear directly linked to fish use. Given a recovery of the cutthroat trout population of Yellowstone Lake, we speculate that grizzly bears in the Lake basin, of which the tradition of fishing has not yet been lost, would once again make use of this high-quality food resource.

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### 109. Estimating the numbers of female grizzly bears with dependent cubs using public bear observation reports in Kluane National Park and Reserve, Yukon Territory (1987-2010)

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Potential population decline, high human-caused mortality outside the park, and the absence of a population monitoring program have led to uncertainty about the population status of grizzly bears in Kluane National Park and Reserve (KNPR). Since 1987, visitors and staff have been encouraged to report grizzly bear sightings within KNPR. This study explored the feasibility of developing a trend index for the Kluane grizzly bear population using the number of observed unique females with dependent cubs ( $F_{\text{cub}}$ ) each year from 1987 - 2008. This study differed from others in that (1) it used all females with dependent cubs, not just those with cubs of the year, as monitoring units, excluding the possibility of any summative methods to determine population trends; and (2) the  $F_{\text{cub}}$  sighting history was recognized to be a subsampling regime based around areas of human activity with some  $F_{\text{cub}}$  in the park being undetectable. Population trends were assessed using two estimators: the partitioned sample coverage estimator (Chao et al. 2000), and the second-order sample coverage estimator (SC2, Chao and Lee 1992). Each estimator was chosen due to its tolerance of sighting heterogeneity among individual  $F_{\text{cub}}$ . Preliminary analysis indicated that the partitioned sample coverage estimator performed the best over the range of conditions presented by the Kluane data. Issues regarding the use of estimators for this type of application are discussed, particularly with respect to effort ( $n/N$ ) and visitor use levels.

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## 110. Analyze of brown bear populations regulating factors in the Romanian Carpathians based on a case study on survival rate and mortality cause of rehabilitated and re - introduced brown bears

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Between 2004-2010 a number of 40 rehabilitated orphan brown bear (*Ursus arctos*) cubs have been released back into the wild at sub-adult age and post release monitored with VHF and GPS telemetry systems. In this study we recorded the surviving rate of the released bears, assessing in the same time the cause of death of those which didn't survive. In parallel we studied the mortality rate of juveniles and sub-adults in the wild in 4 different regions of the Carpathians. We founded a strong correlation between survival rate and age, survival and body weight of the bears and no correlation between surviving and sex of the individuals. According our results, the main reason of sub adult mortality is the intra specific predation, caused by infanticide males, poaching and traffic accidents. According our study, the up mentioned factors are the main brown bear population regulating factors in the Romanian Carpathians, the legal harvest playing a small regulating role (below 10%). The cause of orphaning of the 40 rehabilitated cubs was in 32.5% winter den abandonment of hibernating females caused by den disturbance, 12% the poaching of the females and 55% unknown. Thus we assumed a big role of cub mortality caused by winter den disturbance mainly caused by forest exploiting in denning habitats. As we found a similar pattern for intra specific predation on sub-adult females and males equally, we speculate that infanticide males may be prone to kill sub adult bears without showing any preference towards any sex. Although based on a relatively small sample, our results strengthen other conclusions from the literature that the harvesting oriented towards killing of adult males may have a population consequence that managers should take in consideration. In addition



our results and observation revealed that the poaching has a very big rate in the study area and should be taken seriously in consideration by wildlife managers.

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## 111. Diversionary feeding of black bear in a caribou calving area in eastern Newfoundland, Canada

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As a proximate cause, black bear (*Ursus americanus*) predation annually accounts for 20-55% of mortality in juvenile caribou (*Rangifer tarandus*) on the island of Newfoundland. The Newfoundland caribou population declined ~ 66% since the late 1990s; demographically attributed to extremely low calf survival. Experimental diversionary feeding was initiated in 2010 to test the feasibility and efficacy of this predator intervention as a tool for management.

Between 2008 and 2010, radio-collared black bear and juvenile caribou were monitored in three Caribou Management Areas. During June 2010 (caribou calving season), bait sites were established at a density of 1 per 25 km<sup>2</sup> in one caribou calving area (two calving areas were unmanipulated). Stations were baited with 500-kg bags of bakery waste and monitored by remote video cameras; sites were visited weekly.

More than 11,000 kg of bait were consumed and 259 black bear scats collected for DNA analysis. In 502 videos containing black bear, both males and females were observed, including females accompanied by yearlings or cubs. Collared black bear in the experimental area reduced their range in June 2010 by about 50% compared to previous years; GPS locations collected by these collars were clustered around baits. While bear behaviour appears to have been manipulated, the first year of diversionary feeding did not result in a decrease in calf mortality.

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## THEME: POPULATION ESTIMATION

### 112. Barren ground grizzly bear remote monitoring in the Canadian Arctic

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Documented evidence of impacts of captures on bears and the social pressure to reduce the handling of wildlife has led to the development or improvement of less invasive methods to monitor wildlife while addressing the information needs for a given management system.

This project aims at assessing the status of the Grizzly bear (*Ursus arctos*) population in the Western Kitikmeot, Nunavut, using genetic information extracted from hair collected remotely through hair-

snagging techniques, aerial observations, remote camera data and harvest information. The method does not require any capture of the animals or other invasive type of interaction.

We adapted hair snagging methods developed elsewhere to obtain hair samples from grizzly bears in the tundra environment. We conducted a small-scale pilot study (118 stations over 6,000km<sup>2</sup>) using a 5x10km grid cell for 2 years (April – August 2005-2006) followed by a 2 year (July – August 2008 – 2009) large scale (393 stations over 40,000km<sup>2</sup>) pilot study with a 10x10 grid cell with one station per cell.

We validated some of the assumption for the hair snagging study through data collected by remote cameras at a sub-sample of the hair snagging sites (N=30) and the information collected through aerial observations and the harvest monitoring.

Between the small scale pilot (2005-2006) and the 2008 sampling sessions, we already identified 120 individual bears. Harvest and 2009 sampling sessions' data are currently being analyzed and a discussion on the method and its ability to provide a population density estimate, trend, and harvest rate will be presented at the conference.

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## 113. Population abundance and genetic structure of black bears in coastal South Carolina

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Because of increasing frequency of bear sightings, vehicle collisions, and nuisance incidents in coastal South Carolina, the South Carolina Department of Natural Resources is developing a comprehensive black bear management plan. However, no reliable estimates of population abundance, density or genetic exchange are available. We used genotypes determined from hair samples to estimate population abundance and density for Lewis Ocean Bay and Carvers Bay, South Carolina. We used Huggins closed population models to estimate abundance and spatially explicit capture-recapture models to estimate density. Based on model averaging, black bear abundance was 30 (SE = 9.3) on Carvers Bay and 42 (SE = 5.4) on Lewis Ocean Bay. Model-averaged density was 0.037 bears/km<sup>2</sup> (SE = 0.003) for Carvers Bay, but much higher for Lewis Ocean Bay: 0.307 bears/km<sup>2</sup> (SE = 0.025). We extrapolated the density estimates to the upper coastal region of South Carolina, using logistic regression to weight density based on similarity of the regional landscape with the 2 study areas. Predicted density was low throughout the coastal region but several areas centered on more productive habitats and public lands had high predicted densities. We also sampled an area in North Carolina to assess genetic structure among the 3 areas. Based on heterozygosity, genetic distance, and genetic assignment, we found no evidence of historic or recent barriers to gene exchange among the 3 sampled populations. However, demographic connectivity may be a concern for areas such as Lewis Ocean Bay, which is surrounded by highways and development. If the goal is to maintain current black bear densities in those areas, securing connectivity with other habitat areas and mitigating impacts of highways would be important. The regional map of potential black bear density may be useful to identify areas that should be surveyed for occupancy or where additional studies may be conducted.

## 114. Black bear density in Glacier National Park, Montana

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No demographic information exists on the status of Glacier National Park's (GNP) black bear (*Ursus americanus*) population. In 2004, we sampled the black bear population within GNP plus a 10 km buffer using non-invasive hair collection methods as part of a 7.8 million-acre study of the regional grizzly bear (*U. arctos*) population. We collected 5,644 hair samples from 550 baited hair traps, and 3,798 samples from multiple visits to 1,364 natural bear rubs. Microsatellite analysis identified 601 (51% F) individuals from the 2,819 samples identified as black bears. Data from individual bears were used in closed population mark-recapture models to estimate black bear abundance in the 6,600 km<sup>2</sup> greater GNP area. We then developed an approach using individual detection data to inform buffer size for estimating density. Results suggest that the density of GNP's black bear population was equal to or greater than other interior populations sympatric with grizzlies, despite the high density of grizzlies in this area. This project represents the first estimate of black bear abundance for this area, and demonstrates the efficiency of multi-species projects to inform management.

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## 115. Preliminary estimates of black bear density in caribou calving areas, Newfoundland, Canada

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In Newfoundland, Canada, estimating black bear density in caribou calving areas has become a research priority due to concern regarding the declining woodland caribou (*Rangifer tarandus*) population and evidence of substantial black bear (*Ursus americanus*) predation on neonate caribou. In addition to the usual challenges of obtaining reliable density estimates for large, mobile animals, the areas of interest are remote, thereby requiring a sampling design minimizing the financial implications of helicopter support while maintaining sample quality. Furthermore, caribou often select calving sites with relatively low predator activity, making the task of gaining sufficient samples more difficult.

From June – October 2008-10, black bear hair samples were obtained with baited barbed wire hair snags, spaced 5 km apart in a grid pattern covering known calving areas in three study sites. Hair was collected at approximately monthly intervals. Scat samples were obtained in June – August 2009-10 by a scat dog team walking quasi-circular transects within 12 x 12 km grids covering areas within and outside of calving areas. Individual identification success rates for scat and hair were equivalent (30%), however, scat sampling proved to be more cost effective than hair sampling.

Abundance was calculated with Program CAPWIRE (CAPture With REplacement) allowing for multiple captures in a single session. Sampling area was estimated using boundary strip methods for hair sampling and buffering transect paths on either side with the average radius of black bear seasonal ranges (calculated from local GPS-collared black bear) for scat sampling. Despite relatively low success with individual identification, density estimates obtained were plausible; quality-cost

trade-offs in sampling design still allowed us to obtain reasonable results. Further work including the use of new spatially explicit Bayesian techniques is expected to improve the reliability of these estimates.

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## 116. Estimating the Ontario black bear population at management unit and landscape scales

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Ontario's black bear population occupies over 650 000 km<sup>2</sup> of suitable breeding habitat within a 1 000 000 km<sup>2</sup> area. Habitat productivity and human impacts vary widely across the range. Effective management of such a population requires knowledge of population size at multiple spatial scales to facilitate local adaptive management while ensuring long term population viability at the landscape scale. From 2004-2010, we sampled black bears using barbed-wire hair corrals on 80 study areas in 64 Wildlife Management Units (WMUs). Study areas consisted of curvilinear routes of 15-31 corrals spaced 2 km apart along secondary and tertiary roads; samples were collected on 4-6 occasions in spring and early summer. We identified individual bears from microsatellite DNA profiles at 5-15 loci plus gender. We estimated densities of female bears aged >1 yr on each study area using spatially explicit capture-recapture models, and extrapolated these to estimates of total bear density by simulating population growth and harvest to estimate proportions of females aged >1 yr in hunted and unhunted populations in different forest regions. Densities were extrapolated within WMUs to yield WMU-specific population estimates, which we summed to estimate black bear populations in larger areas. Capture probabilities varied among individuals, in response to previous capture, and among years. Movement rates varied among individuals, years, sampling occasions, and forest regions. Total bear densities ranged from <5 to 56 bears per 100 km<sup>2</sup>. Generally, bear densities were higher in more productive habitat and where bears were protected from harvest. Not all differences could be explained by differences in habitat quality or harvest density. WMU-specific density and population size estimates were incorporated into bear population objective setting and harvest allocation processes, and we developed a preliminary estimate of the provincial population. We discuss advantages of and challenges posed by this approach to population assessment.

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## 117. Predicting grizzly bear density in North America

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Grizzly bears are hunted across vast areas in Canada and field-based estimates will never be available for more than a small portion of the hunted populations. Current methods of extrapolating density to areas of management interest are subjective and untested. Objective methods have been proposed (e.g., using RSF's) but these statistical models are so dependent on results from individual study areas that the models may not generalize well. We examined the relationship of grizzly bear density to ultimate measures of ecosystem productivity and mortality. We found 89 measures of grizzly bear

density in non-coastal environments including 14 currently unoccupied areas that were not surveyed. In coastal areas where black bears were present we found 17 measures of density including 2 unoccupied areas. We used Tobit regression to describe the multivariate relationship between predictor variables and bear density and AIC to help select the best model. Each record was weighted by the relative precision of the population estimate. Our best model for coastal areas included a negative relationship with tree cover and positive relationships with the salmon diet proportion and topographic ruggedness. Our best interior model included 2 variables that indexed terrestrial productivity, 1 describing vegetation cover, 2 indices of diet choice, and 2 indices of human use of the landscape. We used our models to predict population size across Canada and present these as alternatives to current predictions which were subjectively derived. Generally our models predict higher densities than current numbers hence the total population size for Canada is predicted to be higher than that presented in the latest status review. We suggest predicted population sizes can be used to set mortality limits but the poor precision of the predictions must be considered explicitly during application.

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## THEME: RESEARCH ON BEARS IN CAPTIVITY

### 118. Weaning giant pandas in a captive facility

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For all mammalian species, the weaning period marks the necessary transition of young from dependence on maternal resources for nutrition to the independent acquisition of food. Weaning also marks the disassociation of the mother-offspring unit. The process by which the giant panda (*Ailuropoda melanoleuca*) becomes nutritionally independent of its mother is a matter of some speculation, as little is known about the process in the wild. In the zoological setting, however, enclosures and exhibits act as barriers to a natural, animal-driven separation during weaning. Animal managers must then facilitate this process by manipulating barriers and providing opportunities for separation. We report on a weaning separation protocol that fostered a gradual separation of a panda mother from her offspring. One male and 3 female singleton panda cubs were weaned from an adult female over an 8-year period at the San Diego Zoo. The protocol was initiated when a cub had obtained sufficient bamboo-feeding skills at approximately 18 months of age. Behavioral data were collected beginning 1 month prior to the first separation step of the weaning process, and continued for 1 month after final separation. We selected 7 categories of behavior with a priori rationale for their potential relation to well-being. Results suggest behavioral variation among cubs, with the first-born cub demonstrating substantial changes in time spent feeding and playing when compared to baseline. Behavior of the mother was more stable throughout the weaning process with later cubs compared to the first two. Future research would benefit from an increased sample size balanced by gender.

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### 119. The behavioral development of mother-reared sun bear cubs in a captive facility

Hall, Suzanne S.<sup>1</sup> ([shall@sandiegozoo.org](mailto:shall@sandiegozoo.org)) and R.R. Swaisgood<sup>1</sup>

Bear cubs are born highly altricial and are therefore dependent upon their mother to meet their basic needs. Young bears undergo rapid and dramatic behavioral changes in their first year, although this development has not been well documented. An understanding of the normal range of development of cubs can aid in captive breeding efforts for vulnerable bear species. The sun bear *Helarctos malayanus* is a rare species, yet research on the behavior of this bear is limited, and the development of cubs remains largely unstudied. Here we document the behavioral development of mother-reared sun bear cubs in their first year of life. We studied 2 male and 2 female cubs, equally balanced between twin and singleton litters. The denning phase, defined as the period from birth until approximately 15 weeks of age, was observed via remote monitoring using a camera and microphone installed in the birthing den. The remainder of the first year was observed directly. Behavior data was obtained using point-in-time and all-occurrence sampling methods. More than 300 hours of data were collected for the 4 cubs. Preliminary results document the decline in high intensity vocalizations and suckling behavior before the end of the denning phase. Social play and play with objects begins before the cub transitions out of the den. Feeding on provisioned food begins well before one year of age. Additionally, female cubs appeared to achieve earlier markers of independence from their mother compared to male cubs. Further research on cub development would benefit from increased sample size.

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## 120. Maternal selection for cub survival in twin litters of giant pandas

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Among ursids, the birth of multiple-cub litters is common, and mothers are solicitous of the survival of each cub. Twin litters occur in nearly half of all giant panda (*Ailuropoda melanoleuca*) births in captivity. It is reasonable to assume a similar percentage of twinning in wild populations. This phenomenon appears not to be of reproductive benefit, however, because an effective litter size of one is the norm for the species. Cub abandonment in the wild context, if it occurs, would not appear to be related to the seasonal scarcity of primary food resources, as may occur in other carnivores. Bamboo is available to pandas on a fairly constant, year-round basis. Instead, the proximate cause of litter reduction in the giant panda may be based on the highly altricial state of cubs at term, possibly a consequence of adaptation to a diet of low nutritional value. Such extreme altriciality makes heavy demands on mothers in providing essential survival care. Indeed, the panda mother is known to provide a more active form of maternal care than many ursids, devoting considerable effort to holding, grooming and soothing neonates while in the den. Providing such intense support for multiple young may simply be too taxing to ensure maternal success rearing panda twins. Here we utilize years of data recorded in captive breeding facilities to determine the factors that influence which twin cub is selected for survival when litter pruning occurs. Seventeen litters of mixed gender and 15 same-sex litters were examined for the effect of birth order, gender, cub weight and time lag between births on maternal selection for survival. Preliminary results suggest birth weight is significantly higher in first-born cubs. Additionally, birth order is a more significant factor in determining selection by the mother than is cub gender.

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## 121. In den mother-cub behavior and communication in the grizzly bear (*Ursus arctos horribilis*)



Pregnant female grizzly bears enter maternal dens in the fall and remain there until spring emergence. Adequate nutritional uptake is a prerequisite for the transition from altricial neonate to emergent and mobile cub. Presumably, maternal energy conservation is required for reproductive success given the extended fast and concurrent lactational support of cubs. Human-reared cubs have been observed to emit a persistent and loud humming vocalization associated with nursing; however, a detailed assessment of the behavioral context and communicative function of this vocalization is lacking. This vocalization has also been described in free-ranging cubs, as it is often audible outside the den. Here we present descriptive data on in-den maternal care patterns, cub behavior and communication, from 4 litters of grizzly housed at the Washington State University Bear Research Center. Dens were instrumented with digital video/audio surveillance systems. Behavioral and acoustic data were collected on 4 females, over 2 reproductive years. We contrast these data with that collected from 4 non-parturient hibernating females at the same facility. Females without cubs were active in the den 10% of the time during the first six weeks of hibernation. By contrast, parturient females were active 25% of the time pre-partum, and 35% of the time during the first six weeks post-partum. Females with cubs stayed in the den longer than females without. Cubs spent an average of 53% of their time humming over the denning period. When suckling was visible, humming occurred at the outset of 75% of suckling bouts, but was not persistent throughout bouts. These data demonstrate that activity levels in the den are not insignificant, suggesting a possible energetic cost to maternity in addition to lactational support. The close link between humming and the initiation of nursing bouts suggests that this vocalization may facilitate maternal accommodation of nursing and/or milk letdown.

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## 122. Orphan bear rehabilitation centre a pilot project in the Romanian Carpathians

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The orphan bear rehab centre is a pilot project which aims to reintroduce every orphan bear cub from the Carpathians into the natural habitats, after a professionally developed rehabilitation process. The causes why bear cubs remain orphan are diverse and most of them even unknown. We can mention here bad organized huntings, forest exploiting, road or railway accidents, winter den disturbance and others. The base of the rehabilitation method is to offer a natural identical space (large facilities with natural habitat) where the cubs can develop their behavior. During the rehab period the feeding is partly based on the natural food sources from the facilities (forest fruits, grass, ands) and partly on artificially offered food. The rehab process lasts maximum two years, the release moment being evaluated according with the animal's physical and behavioral development. Until 2010 more than 40 rehabilitated bear cubs have been reintroduced in the Romanian Carpathians. The rehab project offers not only solution for the orphan bear cases in the Carpathians, but also many opportunities for scientific research related with the specie's behavior and ecology, such as: studies on juvenile natural dispersal during the foraging process, habitat use and home range analyze of brown bears, regulating factors in brown bear populations in the Carpathians, factors influencing the winter sleep and denning behavior, the habituation process and factors influencing it, diet of the brown bears and several others.

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## 123. Captive bears' welfare research in Poland: results and improvements

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The keeping and conditions of bears in zoos is a frequently common problem in many European countries, with bears frequently being kept in unsatisfying accommodation with regards to Five Freedoms concept. Captive bears' welfare research in Poland started in 2007 in cooperation with RSPCA and OTOZ Animals. The main aim of research was to assess the welfare of bears in all aspects - housing conditions, if biological needs are fulfilled and to study behaviour for abnormalities. The study was carried out in all Polish zoos and other captive institutions which keep bears. The questionnaire based on Five Freedoms approach (Young, 2003), welfare assessment methodology for zoo animals (DEFRA Zoo Forum) and continuous scan sampling for behavioural observations (Martin & Bateson, 1993) with video recording was used for research. The analysis of housing included the size of cages and enclosures, if permanent facilities are present, type of surface, providing water to drink and swimming, diet and feeding techniques, enrichment and outdoor access (daily and throughout a year). The initial survey found 52 bears being kept in 13 institutions. As main welfare problems (1) insufficient space, (2) inappropriate surface, (3) inappropriate diet, (4) no pools and lack of water to drink, (5) lack of proper stimulation and (6) lack of professional and veterinary care were specified. The following types of abnormal behaviours were observed: pacing, weaving, head-twisting, tongue-playing and self-biting.

Before completing the triennial study, in few institutions new enclosures for bears were already planned. After presentation on results in media and on specific meetings and conferences, also in other institutions situation has changed. Few still remain as with really poor bear welfare. Those are having severe financial problems so now some activities are undertaken by scientists and animal welfare organizations to help where the situation is the most difficult to solve.

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## 124. Stereotypic behaviour patterns and other stress indicators in captive bears

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Bears in captivity are highly susceptible to the development of stereotypies. In the wild they spend most of their time foraging while displaying a wide variety of exploratory and manipulatory behaviours. While free-ranging bears need a lot of time and effort to forage (Renner & Lussier, 2002; Clubb & Vickery, 2007), in zoos they consume food with minimal effort. Their natural foraging behaviour is frustrated both regarding quantity and variety. Unfulfilled foraging and other natural motivations, enclosure size – mostly insufficient for this wide-ranging species, lack of proper stimulation and enclosure structuring contribute to high levels of stereotypy (Clubb and Mason, 2003; Clubb and Vickery, 2007; Kolter, 2002; Peyton, 1997).



Stereotypic behaviour of 10 individuals at Wroclaw zoo was scanned at constant intervals and recording was continuous (=all occurrences) (Martin and Bateson, 1993). Bears were observed from 7.30 a.m. till 5.30 p.m. Research lasted two seasons - April-September in 2006 and 2007. Analyses were conducted for all aspects of stereotypical movements: form, bout duration, number of cycles in one session, frequency, intensity and total amount of time devoted for stereotypic behaviour. As part of this study, also the cortisol metabolites levels were measured in faeces. Non-invasive sample collection is advantageous to welfare and with easily repeated sampling, it allows to gain more comprehensive data and long-term monitoring of the dynamics of the stress response (Palme and Moestl, 1999; Goymann et al. 1999; Huber et al. 2003; Hunt and Wasser, 2003). Fecal samples have been collected for 11 months (April 2006 – February 2007) from 11 individuals (additionally from bears kept with no access outdoors).

Behavioural response, increases in cortisol metabolites and relation between the intensity of abnormal behaviours and stress hormone levels is an important tool in the management of stress in captive animals.

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## 125. Age affects embryonic diapause in female giant pandas (*Ailuropoda melanoleuca*)

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Like other ursids, giant pandas (*Ailuropoda melanoleuca*) exhibit delayed implantation. Limited ultrasound data suggest that true gestation lasts about 50 days. However, the period of pre-implantation diapause is highly variable among captive females, and ranges between 40 and 110 days. Neither intrinsic (such as hormones or nutrition) nor extrinsic (such as photoperiod) factors influencing the length of diapause have been identified in the panda. While diapause serves to optimize the timing of parturition in a species, additional fine-tuning of the reproductive system may be expected with individual age and experience. In the giant panda, attenuation of reproductive behavior has been documented due to age, with shorter periods of overt estrous behaviors displayed in older females. Here we investigate the impact of age on diapause length. Data were collected across multiple years from eight female pandas housed at the San Diego Zoo and at the China Conservation and Research Center for the Giant Panda. For our descriptive analysis, embryonic diapause began on the day of first copulation, or insemination, and ended 50 days before parturition. Fifty percent of the females in our study exhibited sequentially shorter diapause from year to year, while the remaining 50% exhibited variable gestation lengths. These data suggest that age may influence diapause length in some females, a finding that increases manager's ability to predict the timing of birth and adds new insights into the phenomenon of embryonic diapause in ursids.

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## 126. Zoos and their role in conservation of bear species in India

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There are 199 facilities recognized as “zoo” by the Central Zoo Authority (CZA) in India. The study was initiated to assess the role of zoos in conservation of bear species in captivity. In this context data since April 1995 to March, 2009 on the animal's birth, acquisition, disposal and deaths were analyzed. There have been 99 birth and 384 cases of death and 781 cases of bear acquisition in zoos since April 1995. Housing of sloth bear and Asiatic black bear was reviewed and found that very few zoos could fulfill minimum prescribed area limit of enclosures and dimensions of feeding and retiring cells. The study reveals that sloth bear, Asiatic black bear, brown bear and Malayan sun bear, those were distributed initially in 71, 70, 8, and 4 zoos respectively, are now restricted to only 33, 47, 1 and 3 number of zoos which is apparently due to very low success in breeding and high death rate. There are only 9 zoos out of 71, which have birth record of sloth bear whereas all the 64 birth cases of Asiatic black were observed only in 21 zoos.

The present trend of bear conservation in Indian zoos is not encouraging and zoos are just being act only as lifetime care facilities. For the better & scientific management of zoos including record keeping, the CZA has reformed its rules and guidelines, and hope that their adoption by zoos will ensure conservation of bear species in captivity.

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## 127. Chronic kidney failure in captive Asiatic black bear

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Chronic kidney failure is the most common form of kidney disease in pet-animals, especially older ones, but there is little known about this syndrome in bears. It is considered incurable. It progresses slowly over a period of years and often goes unnoticed. In this study we demonstrate the case of chronic kidney failure in 32 years old Asiatic black bear (*Ursus thibetanus*) male that lived the entire life in a zoo (Braniewo, northeastern Poland). Since 2007 bear had been showing gradually decreasing activity and appetite. The developing cataract was also observed. Because of all those signs, the decision was undertaken to conduct detailed clinical and hematological examination. The results showed excessive arthritis, swelling of all legs and developed cataract in both eyes. Serum biochemistry and hematological examination showed elevated level of creatinine (1093 µmol/l) and urea (35 mmol/l) and erythropenia (3,66 T/l). Due to results of examination it was decided to euthanize the bear. At the necropsy the samples of the organs (liver, spleen, kidney, lungs, intestines) were taken for histopathological and microbiological analyzes. The samples for histopathology were fixed in 10% formaldehyde solution, embedded in paraffin, cut into slabs and then hematoxylin and eosin (HE) staining was undertaken. Macroscopically both kidneys were pale pink and the cut surface revealed pale color and hard structure of cortex and medulla. The documented pathology confirmed the chronic kidney failure, which explains much of the health problems exhibited by the bear.

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## 128. Hematologic and serum biochemical values of "semi" hibernating captive brown bears

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The study was conducted in the Braniewo zoo (northeastern Poland) on six brown bears (*Ursus arctos*) on 17 February 2011. The mean outside temperature during the winter period in the location was -14 °C (range in December-February: -24 to -4). The routine Zoo practice included daily offer of food and water and releases outdoors every other day. However, sleep/rest was dominant bear activity both in outdoors and indoor cages (indoors temperature: -4 to +2 °C). Under these conditions bears were in a kind of “walking” hibernation, or half way between full activity and real hibernation. Low temperatures seemed to stimulate to hibernation but routine feeding and regime of releasing outdoors stimulated activity. The atypical behavior of studied animals was correlated with physiological signs of slight hibernation. The rectal temperature of all bears was below normal with mean 35.9 °C (34.9-37.0).

All animals were chemically immobilized and blood samples were collected. Hematologic and biochemical parameters were determined. The means and range values of hematological parameters were the following: red blood cells 6.98 (6.34-8.0) T/l; haemoglobin 174 (157-197) g/l; haematocrit 0.49 (0.43-0.55) l/l; white blood cells 6.37 (4.82-8.93) G/l; neutrophils 4.93 (3.64-7.65) G/l; lymphocytes 1.06 (0.76-1.47) G/l; monocytes 0.33 (0.23-0.49) G/l; eosinophils 0.22 (0.004-0.09) G/l; basophils 0.12 (0.006-0.02) G/l; platelet count 326.1 (205-766) G/l. Means and ranges of biochemical parameters were the following: albumins 41.1 (27.0-47.6) g/l; ALT 19.1 (17.3-22.3) U/l; alpha-amylase 38.5 (20.7-65.8) U/l; AP 31.1 (10.3-53.4) U/l; AST 74.5 (58.1-113.4) U/l; total protein 82.0 (77.6-88.7) g/l; bilirubin 1.31 (0.69-1.67) µmol/l; cholesterol 7.14 (5.62-9.28) mmol/l; CK 256.6 (35.1-787.7) U/l; GLDH 7.36 (5.95-8.90) U/l; gamma-glutamyltransferase (GGT) 31.9 (11.5-105.7) U/l; creatinine 207.8 (138.7-278.8) µmol/l; LDH 476.6 (412.6-649.2) U/l; lipase 46.3 (11.8-87.5) U/l; urea 3.5 (2.78-44.4) mmol/l; triglyceride 3.18 (1.85-5.43) mmol/l; cholinesterase 922.4 (353-1361) U/l.

This report may be useful to develop and evaluate health profiles, exhibited by values of hematology and biochemical parameters, of bears in the stage between full activity and hibernation, especially because some values were different from those presented by other authors.

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## 129. Chronobiological shifts in captive newborn giant panda cubs (*Ailuropoda melanoleuca*)

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Despite the general interest in the rhythmical organisation of mammal life, only few studies have examined the development of this timekeeping system. The structure of circadian rhythms in giant panda can serve as a case study. Here, we provide the very first results on the behavioural ontogeny of two giant panda cubs, born at the Vienna Zoo in 2007 and 2010, including the development of their activity rhythm and time budgets. We also investigate whether zoo-specific external factors (e.g. animal keepers, zoo visitors, medical examinations etc.) influence the activity rhythm of the cubs.

Lomp-Scargle Periodograms revealed that circadian rhythmicity is not fully established at birth, but develops within the third and fourth month. Whereas the activity of the cubs is evenly distributed over 24 h within the first month, they become increasingly diurnal thereafter. Adults, in contrast, show two activity bouts (mainly feeding behaviour) between 8a.m.-10a.m. and 3p.m.-6p.m. Although the animal keepers do not directly affect cub behavioural patterns, they clearly influence the dams' behaviour due to their daily routine.

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